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The Chancellor and Oversea Trade.

OUR comment regarding the future of the Department of Overseas Trade had gone to press last week when the Chancellor of the Exchequer delivered his Budget speech.

Successive governments have in their search for economy turned their attention to the new Departments created since the outbreak of war in 1914, and for some reason or other their eyes have turned upon the Department of Overseas Trade with a distinctly reproachful look—an unnecessary member of the family, a late arrival, a small, harmless, comparatively inexpensive creature, but *such* a millstone round the neck of its parents!

How did this unwanted child come into existence? Was it not once the puny offspring of two Departments of State, namely, the Board of Trade (Commercial Intelligence Branch) and the Foreign Office? Was it not felt that by such a combination, efforts of a divided and scattered character could be concentrated and that a necessary service could be rendered to the trading interests of the nation—a service for which there was a need, they having been sadly neglected in earlier years? And does not the business world in 1927 pay unmistakable tribute to its usefulness?

The Ministry of Transport is to be abolished "as a separate department," while some of its activities will be continued; the functions of the Mines Department are "to be distributed," and, says the Chancellor, "The Prime Minister has also decided that arrangements shall be made during the present financial year to . . . *terminate the separate* existence of the Overseas Trade Department." Note that our Herod does not propose

to present three heads on a charger for the delectation of the modern Salome, who dances for economy at all costs. The precise words may possess special significance. It is one thing to abolish a Ministry as a separate department; another to distribute the functions of an unwanted department; and may be something else altogether to "terminate the *separate existence*" of a third. We shall have to wait and see exactly what is meant when the promised legislation relating to them is brought before Parliament for consideration. But we do hope that somebody who remembers what happened in the old days when trade intelligence matters received such poor attention under the divided control of the Board of Trade and the Foreign Office will have an influential voice in settling what the future shall bring. The last thing in the world that anybody ought to want is a return to pre-war inefficiency in this connection as in the days when the Commercial Intelligence Branch of the Board of Trade was the Cinderella in a Basinghall Street kitchen.

Sir Eric Geddes with his axe wanted to cut off the Department of Overseas Trade's head years ago; yet he was once a president of the Federation of British Industries. It used to be said in those days that the F.B.I. had no use for the Department—that its own organisation sufficed. But since the Chancellor made his speech, one of the most important objectors to the proposed change has been Sir Max Muspratt, the present president of the Federation. The Chambers of Commerce of the United Kingdom, whose voice should also carry weight, are strongly in favour of its retention. We cannot think that either the Prime Minister, whom the Chancellor credits with the decision, or the Chancellor himself, can be alive to the overseas trade information-getting activities of governments in competing industrial countries, or they would not advocate a reduction of operations by this country when we are faced with a very stiff competitive contest for our so essential export trade.

We do not criticise the policy of abandoning unnecessary departments and striving after economy; nor should we object to the reorganisation of the Department of Overseas Trade if it were found to have added needlessly to the number of ornamental officials. What we are anxious about is that the useful service that experience proves it able to render shall not be scrapped; that the future of the work of our Trade Commissioners shall not be of less but of greater value; that the British Industries Fair shall be developed still further from year to year; and that the ceasing of a "separate existence" shall not mean that the experience accumulated by and recorded in the Department will be smothered among the multiplicity of interests in a department which, like the former Board of Trade and a distinguished old woman living in a shoe, had so many children that none of them received the proper share of attention.

In doubt as to what the Chancellor means, the first impression is that, if the worst comes, it may be necessary for the individual manufacturer and trader more earnestly to seek out his own information to the best of his capacity; for trade associations to organise themselves for more efficient collection of information from oversea markets for the benefit of their members; and for organised and unorganised traders alike to enable the trade Press to increase still further its trade information-collecting services.

London's Traffic.

All who have read the recent report of the Royal Commission on Cross-River Traffic will agree that, so far as road transport is concerned, their recommendations embody a far-sighted and effective scheme for the relief of many of London's traffic difficulties. We were glad to read the Prime Minister's announcement that the Government proposed to support the main outlines of the scheme, and had asked the Southern Railway and the L.C.C. to co-operate in the appointment of engineers to prepare designs for the proposed double-deck road and railway bridge at Charing Cross.

While we admit the comprehensive nature of the scheme, as far as road transport is concerned, it must be a matter of regret that, with regard to railways, the proposals might (with one exception) have been made in the days of steam traction. The only reference to electrification (embodied in the thirteenth appendix to the report) is that the Southern Railway Co. regards it as "a temporary palliative." The only development in this direction is that the double-deck bridge at Charing Cross excludes steam traction from this small section of railway which, under the present policy of the Railway Co., is of decreasing importance. A wider conception of the advantages which electrification offers, particularly in the way of underground traction, would surely have given rise to some scheme by which the present congestion, both on rail and road, at the many terminal stations of the Southern Railway could have been reduced or even removed.

It is proposed to spend £12,500,000 in the central area, in which is included the cost of a new railway bridge and station at Charing Cross, and a new station and a considerable length of new track at Holborn Viaduct and Blackfriars. In spite of this very substantial expenditure, the railway facilities will not be in any way improved, but rather, if the fears of the Southern Railway are justified, slightly restricted.

At the present time there is a tendency to think of development almost exclusively in terms of road transport. Certainly since 1921, the 'bus passengers have increased from 932 million to 1,671 million passengers per annum, while railway passengers (including the tubes) have fallen from 912 to 875 millions. At a time when road traffic is increasing at such a rate that it is difficult to see how the roads are to be made adequate for their task, it is as much to the advantage of the roads as of the railways that rail facilities should be so developed as to induce as many passengers as possible to return to the trains. If, as seems possible, a practicable scheme can be developed to achieve this, it is to be hoped that it will secure the support of the engineering industry and, in due course, of the general public and the traffic authorities.

Improving the Load Factor.

The secret of cheap electricity does not reside in power stations or mains or any other engineering device—it is above all a question of management. The aim should be to produce the maximum output of energy with a given capital outlay; to fill up the valleys of the daily, weekly, and monthly load curves, so that the plant is used at full load for, if possible, the whole time. Then the cost of the kilowatt-hour is little more than the cost of fuel, which is not much even in a small station—and under such conditions of loading, old and inefficient plant can be replaced by new without materially affecting the unit cost.

In considering the probable future character of the domestic load, elsewhere in this issue, Mr. E. G. Ross is somewhat concerned because, according to his synthesis, that load appears to be "peaky"; but we would point out that the shape of the curve of each class of load is immaterial provided that the peaks of one class are not superposed upon those of another. In other words, search should be made not necessarily for loads with good load factors of their own, but for loads which occur or can be made to occur at times when other demands have fallen off. The heating of water during the night is a typical example of a most desirable load in this respect, as Mr. J. W. Meares points out, and we may add that whilst the heating of houses throughout by electricity is at present neither satisfactory as a fill-up load nor, in general, commercially practicable, the heating of the water supply is both, even under existing conditions. Hence station managers should do their utmost to develop this valuable load by offering attractive terms.

Wireless "Beam" Communication.

Details of the short-wave stations built for the Imperial Telegraph Service between England and Australia.

THE short-wave "beam" wireless-telegraph stations built for the British Post Office by Marconi's Wireless Telegraph Co., Ltd., for communicating with Australia have fulfilled the conditions specified, for their guaranteed capability of maintaining communication at a speed of 500 letters per minute

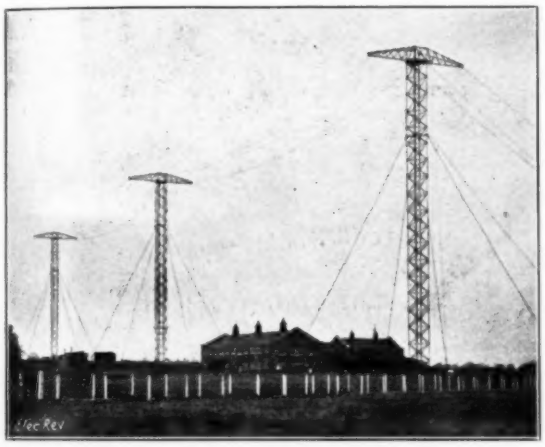


Fig. 1.—The Grimsby "Beam" Telegraph Station.

each way (exclusive of repetitions necessary to ensure accuracy) during a daily average of seven hours, was demonstrated by actual working for seven consecutive days, between March 7th and 14th.

Amalgamated Wireless (Australasia), Ltd., which is operating the service in Australia, reported that during the first six days of the test the average number of words telegraphed each way per day amounted to 148,000, which is equivalent to a speed of 103 five-letter words per minute each way throughout the whole 24 hours. This average was raised to substantially 150,000 words per day, and on many occasions traffic was dealt with at a speed of 225 words per minute, whilst high-speed duplex communication was carried on during the seven days for an average period of over 13 hours per day.

The engineer-in-chief of the Post Office (Col. T. F. Purves) has issued to Marconi's Co. an official preliminary certificate to the effect that the stations have satisfactorily fulfilled the conditions required, *viz.*, "of being capable of sending and receiving at the same time to and from the Australian stations 100 words of five letters each per minute during a daily average of seven hours in accordance with Clauses 6 and 17 of the 'beam' agreement. In a letter to Mr. R. N. Vyvyan, engineer-in-chief to Marconi's Co., Mr. E. H. Shaughnessy, assistant engineer-in-chief of the Post Office, states that the Post Office scrutiny of the results of the seven days' trials indicated that effective both-way communication in accordance with the terms of the contract was maintained for a total time of 88.5 hours during the week (the contract required a total time of 49 hours only).

The receiving station in Australia is situated at Rockbank, near Sydenham, 15 miles from Melbourne, and the transmitting station near Ballan, 50 miles north-west of Melbourne. The service was opened for public use on April 8th, the English stations being similar to the Canadian service stations*; as the latter will be shared by the South African service when ready, so will those illustrated herewith be utilised for the service to India also.

The Grimsby Station.

The transmitting station at Tetney, six miles S.S.E. of Grimsby town, is 25 ft. above sea level: the aerial for the Australian "beam" extends N.N.W., and that for the Indian system extends south. Fig. 1 is a view of the station, the machinery hall being on the left and the transmitter room to the right; the left of the picture faces east. The transmitter delivers 20 kW to the valves of the main, or last, stage of magnification, which feeds the aerials.

Power Plant.—Electricity is obtained from the Grimsby Corporation by an underground cable, delivered as 3-phase, 50-cycle power at a normal pressure between phases of 6,300 volts, and is transformed by a delta-star 250-kVA bank of three single-phase transformers to 3-phase, 400 volts between phases and 230 volts single-phase to neutral for lighting and heating the station buildings. The transformers (by Messrs. Johnson & Phillips, Ltd.) feed through an l.p.

Fig. 2.—The Valve Rectifier Plant; "Smoothing" Condensers Behind.

switchboard in the machinery room: (*a*) Three alternators (by Crompton & Co.), each of 50 kVA, single-phase,

* Elec. Rev., October 29th, 1926.

at 1,000 volts, 300 cycles, for supplying from 8,000 to 10,000 volts to the anodes of the transmitting valves, after passing through special single-phase, step-up transformers, and the valve rectifying and smoothing apparatus; (*b*) three alternators (by the Electric Construction Co.) each of 1.5 kVA single-phase at 220 volts, 500 cycles, for energising at 2,000 volts the anodes of the valves in the drive (or master oscillator) panels of the transmitters, through special single-phase, step-up transformers and valve-rectifying and smoothing apparatus; (*c*) three alternators (by the Electro - Dynamic Construction Co.), each of 10 kVA single-phase at 500 volts, 300 cycles, for heating the filaments of the main and drive rectifying valves at 11 to 12 volts through step-down transformers; (*d*) three generators (by Messrs. E. R. and F. Turner, Ltd.), each of 7½ kW d.c. at 24 volts, one for each transmitter, to supply the filaments of the oscillator and absorber valves and also to charge the batteries which heat the filaments of the master-oscillator valves; (*e*) two d.c. generators (by E. R. & F. Turner, Ltd.), each of 12 kW at 110 volts for exciting the alternators and the control and signal relays. The motor control pillars were supplied by the Airedale Electric Manufacturing Co., Ltd., the switchboards by the Harland Engineering Co., Ltd., and cables by W. T. Henley's Telegraph Works Co., Ltd.; Stanley Cooper & Co. carried out the electric lighting installation, and a two-ton hand-operated travelling crane by Herbert Morris, Ltd., spans the machinery room.

Fig. 3.—The Transmitter Room: Australian Service Plant on Left and Indian Service Gear on Right.

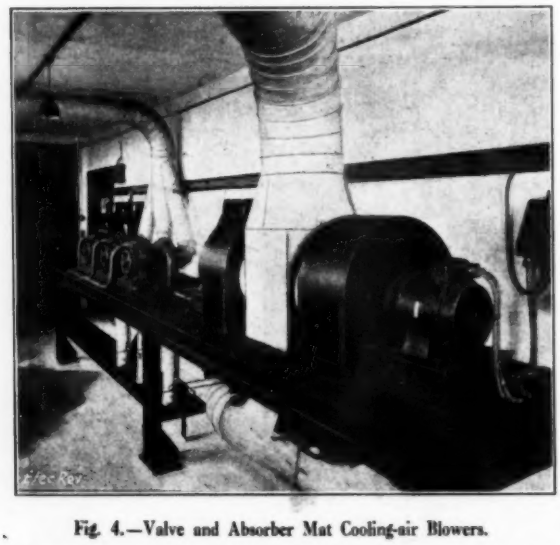


Fig. 4.—Valve and Absorber Mat Cooling-air Blowers.

Batteries.—Four 8-cell, 16-volt, 420-amp.-hour batteries by the Hart Accumulator Co. (two being used alternately for each transmitter) supply the filaments of the oscillator valves in the drive and No. 3 magnifier panels. Two 400-volt, 5-amp.-hour unpasted lead batteries, each consisting of 220 cells, supply negative voltage to the grids of the magnifier and sub-absorber valves. Two 200-volt batteries and 6-volt portable ones work the local heterodyne oscillator listening set.

Radio Plant.—One main and one drive rectifier (two sets) provide the high-voltage d.c. anode supplies for each transmitter: each main rectifier carries a bank of 16 MR7a valves, and each drive rectifier two MR7a valves. The main power transformers were manufactured by Ferranti, Ltd., and the main rectifier-filament transformers by Johnson & Phillips, Ltd. Control tables are mounted between the two transmitters, which face each other. In the case of the Indian transmitter (fig. 3, right) isolating links have been provided for changing over the anode supplies to either of the two "drive" panels, each of which is tuned to one of the two wave-lengths for which the transmitter is designed.

The two high-speed keying relays are of the A.T.M. standard type, and a 4-pole change-over switch enables one or the other to be put into use instantly. The wireless transmitting apparatus and rectifiers were designed and constructed at the Chelmsford works of the Marconi Company, and the valves used were manufactured at the M.O. Valve Co.'s works in London. The brick buildings were constructed by Holloway Brothers, Ltd. Water for the requirements of the station is obtained from a well. Fig. 4 shows, in the background, the three Sturtevant blowers which supply cooling air for the seals of the main magnifier valves, whilst in the foreground can be seen the two blowers which furnish air for cooling the absorber mat resistances through which the load is shunted from the magnifiers when the transmitting key is "spacing." This method of keying has the great advantage of needing only one small relay between the land-line and the transmitter, which means only one small mechanical motion.

Controls.—On the control tables (fig. 3, centre) are three potentiometer-type regulators, one controlling the voltage of each main power alternator, and three similar regulators for the voltage of the drive-power alternators, thus giving complete control in the transmitter room of the high voltages from the power house. There are also two filament control tables, one for each transmitter, carrying variable resistances for varying the filament current in easy stages; they are completely cut out during the normal working of the set. Variable resistances on the transmitter panels themselves allow for slight differences in filament voltages of similar types of valves and for minor variations on the main

filament busbars; there is a separate control for each valve.

Other tables carry land-lines controlling instruments and the local heterodyne oscillator set by which the outgoing signals can be checked or listened to. There is also a standard wave-meter for checking the length of the wave being radiated.

Call Letters and Wave-Lengths.—The Indian transmitter is arranged for signalling on two wave-lengths of approximately 35 and 16 metres, one of which will be used for night and the other for daylight communication. The call-letters of the England-India service are GBI. The Australian transmitter is arranged for transmission of signals to Australia on a single wave-length of approximately 26 metres. The call letters of the England-Australia service are GBH.

Masts.—In the case of the Indian service, there are five masts in a straight line, at right angles to the great circle bearing to India; they carry the vertical aerial and reflector wires which project the beam. In the case of the Australian service, there are three masts only in a straight line, at right angles to the great circle bearing to Australia; they carry two parallel rows of vertical aerial wires with vertical reflector wires fixed between them, which arrangement makes it possible to project a beam along the great

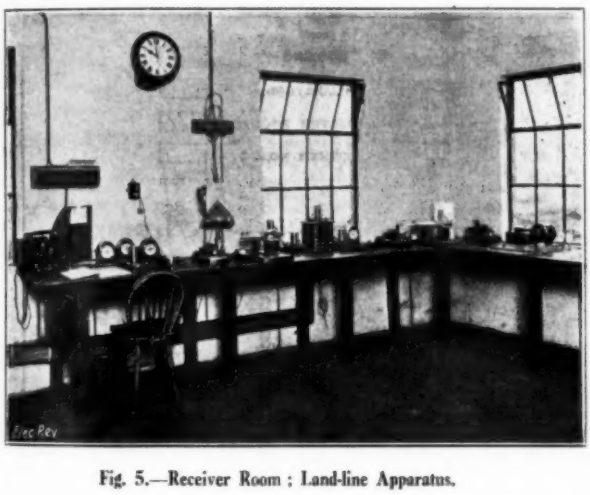


Fig. 5.—Receiver Room; Land-line Apparatus.

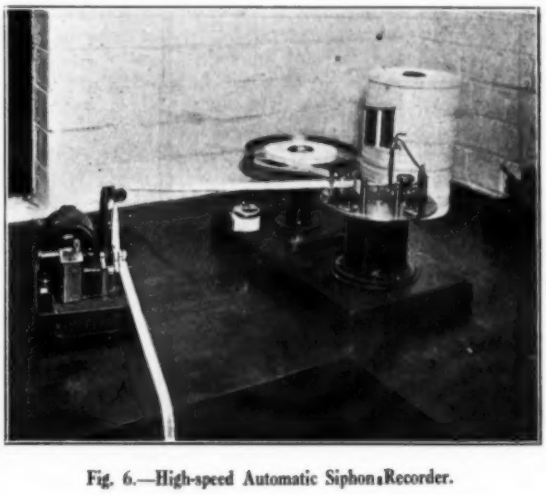


Fig. 6.—High-speed Automatic Siphon Recorder.

circle to Australia in either easterly (evening, 9,000 nautical miles) or westerly (morning, 12,000 miles) directions.

The masts (manufactured and erected by Messrs. Francis Morton & Co., Ltd.) are of steel lattice construction and weigh 38 tons; they are of square section 12 by 12 ft. The overall height of the masts is 287 ft. in the case of the Indian masts, and 260 ft. in the case of the Australian masts; the top steel cross-arms, weighing 3 tons, are 90 ft. long. The masts are spaced 650 ft. apart, and the total length of the line of the five Indian masts is 3,150 ft., and 1,300 ft. less in the case of the three Australian masts.

Aerials and Reflectors.—For the Indian service (two bays for each wavelength) each of the two 35-metre bays has 16 vertical aerial and 32 vertical reflector wires; in each of the 16-metre bays there are 24 vertical aerial and 54 vertical reflector wires. For the Australian system there are two parallel aerials, back to back, with one reflector fixed between them, each having 16 vertical aerial wires per bay, and the reflector, common to both aerials, consists of 32 vertical wires per bay; in the aerial wires phasing inductances are inserted at intervals. The reflector wires are made up of insulated lengths, and the distance between the aerial wires and between the aerial and the reflector wires bears a definite relation to the wave-length employed. The wires are suspended on the "double-catenary" system, and the lower end of each is made fast to a balance-weight structure.

Feeder System.—The high-frequency current from the transmitter-house is conveyed to the aerials through a feeder system consisting of two concentric copper tubes, the inner one centred in the outer by porcelain insulators. The outer tube is earthed and carried on iron standards driven into the ground. Very careful attention was needed to ensure mechanical and electrical symmetry within fine limits throughout its length.

The Skegness Station.

The "beam" receiving station at Winthorpe, about two miles N.N.W. of Skegness, has open country around it in all directions. Power is generated by two 18-h.p. Aster two-cylinder petrol-paraffin engines directly coupled to two Metropolitan-Vickers 10-kW dynamos supplying a 110-volt main switchboard for charging the battery used for lighting the station and for driving four motor-generator sets (by the Crypto Electrical Co.), two of which sets charge the 4-cell filament batteries and two the 110-cell anode batteries; the plant is thus duplicated throughout. The batteries are of Tudor make. The receivers stand near the wall where the feeders enter the building. At one end of the room is a table for the recording apparatus and land-line apparatus (fig. 5): on the left can be seen a key and P.O. "omnibus" sounder for communicating with the transmitting station and the Central Radio Office in London for control purposes; next are two sets of high-speed recording apparatus (Marconi UG.2 type), with tape pullers to the left of each (fig. 6 is a close-up view of one set); and on the right is a Wheatstone transmitter for land-line testing purposes. The received signals are put direct to line through A.T.M. high-speed relays, and can be checked for formation by means of undulators.

Aerials.—The masts, receiving aerials, reflectors, and feeder system are duplicates of those at the Grimsby transmitting station. The masts are at right angles to the direction from which the signals are received, the effect of the reflector wires being not only to screen the aerial from signals coming from behind, but also to reflect back to the aerial energy received from the front of the system exactly in phase with that directly induced.

Receivers.—Each of the two Marconi short-wave beam receivers consists of 10 units, each contained in a copper screening box to obviate interaction. They are mounted in a vertical iron rack, enabling them to be adapted for any special purpose by simply replacing one or more units.

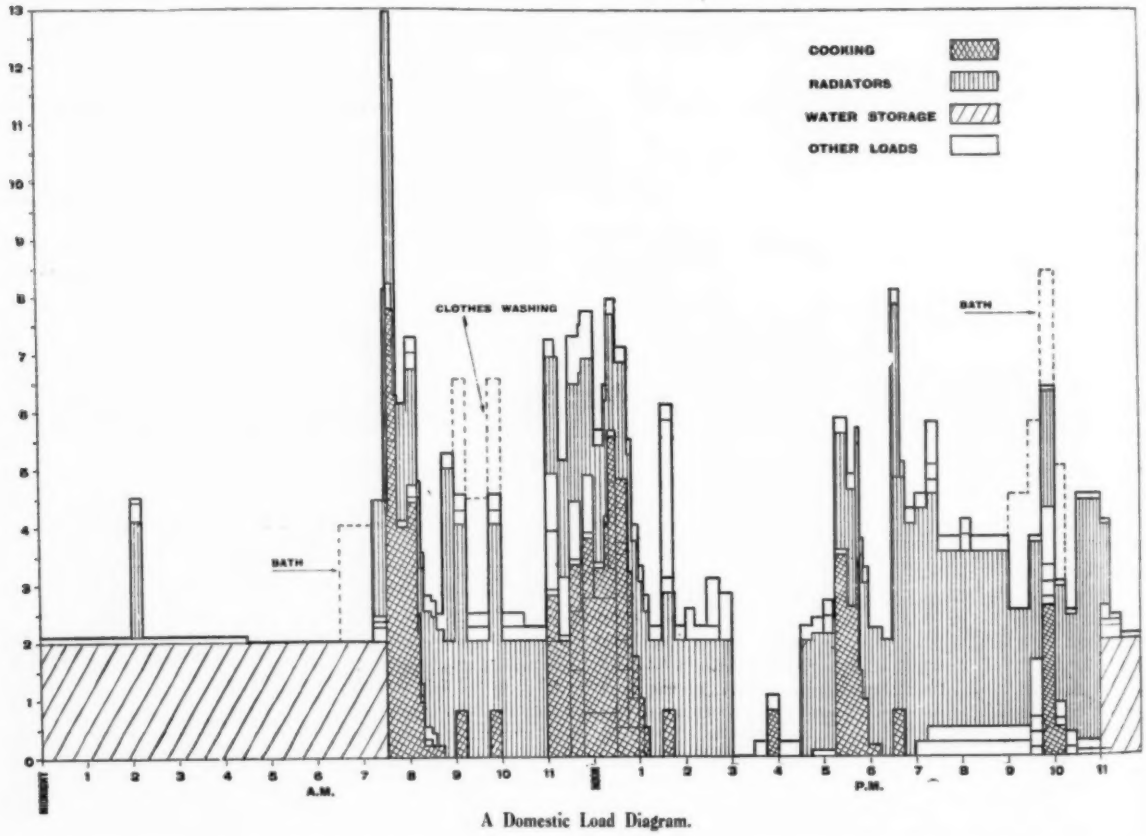
The receiving and recording apparatus was designed and manufactured at the Chelmsford works of Marconi's Wireless Telegraph Co., Ltd. The valves were manufactured by the M.O. Valve Co., cables were supplied by W. T. Henley's Telegraph Works Co., Ltd., and motor starters by Veritys, Ltd.

The Domestic Load.

Suggestions for its improvement based upon a detailed analysis of its constituents, and of the periods during which electrical apparatus is in operation in the home.

By E. G. ROSS, A.M.I.E.E.

THE country's Domestic Electrification Scheme reaches out to secure the conversion of a load, the exact dimensions of which, as a whole, are probably beyond computation at the present time, and of which, in its individual parts, not nearly enough is yet known. It is, however, already time to look to the future, particularly having regard to the Ministry of Health's tendency towards the subsidising of cheaper houses than hitherto, and to the similar tendency of private building schemes.



A Domestic Load Diagram.

Also, the effects of the E.D.A.-E.L.M.A. campaign are beginning to be felt. Although the gross results will not be known for some time, they are undoubtedly certain.

Again, however unpopular the Government's electricity measure may be with the profession, that it *is* popular with the lay mind is apparent to the veriest electrical tyro. Electric power, generally, could not have had a better advertisement, and the exceptional psychological effect of the Bill on the lay mind will be felt in trade circles before very long.

The potential consumers concerned at present occupy residences of from three to seven apartments (including kitchenette, &c.). The lower-sized homes are expanding on account of desire, prevention of overcrowding, and so forth, while the larger-sized dwellings are decreasing purely on account of first cost, and the more efficient expenditure of money. It is, therefore, safe to say that the average electrified house of the approaching future will comprise four residential apartments plus a kitchenette (*i.e.*, two bedrooms, living or dining room, drawing room, and kitchenette).

The daily load of such homes must develop primarily in proportion as electricity is regarded as a convenience. The present margin between "all-electric" and other house costs is too fine to influence domestic electrification as much as is desired; but the "convenience" load must, in time, alter this state of affairs. American development has shown that immediately the "convenience" movement began to take effect, practically every power undertaking of note had its hands full (day load). Human nature being much the same the world over, it is reasonable to apply the same principle to this country. Consequently "convenience" load will ultimately result in "cheap power" load, other factors being equal; and this, in its turn, will influence still greater "convenience" loading.

Therefore any daily-load characteristic that is considered should take account of the "convenience" aspect of the home, and it is suggested that provision

must now be made in mains, to accommodate a future average connected load made up as follows:—

Lighting	.950 kW
Radiators	5.000 ,,
Cooker	7.000 ,,
Hot water (heat storage) ..	2.000 ,,
Kettle (two pint)	.800 ,,
Coffee jug	.500 ,,
Child's milk heater	.300 ,,
Toaster	.600 ,,
Table hot-plate	.200 ,,
Bed warmer	.100 ,,
Iron (5½ lb.)	.450 ,,
Wash boiler	3.000 ,,
Washing machine	.350 ,,
Vacuum cleaner	.250 ,,
Fan	.070 ,,
Refrigerator	.250 ,,
Curling-tongs heater	.750 ,,
Hair-drying blower	.200 ,,
Violet-ray apparatus	.060 ,,

giving a total connected load of nearly 23 kW; not a negligible load by any means! Nor an impossible one; for at the present time the same average "all-electric" house has a connected load of:—

Cooker	7.000 kW
Lighting	.750 ,,
Iron	.450 ,,
Kettle	.800 ,,
One radiator	2.000 ,,
Vacuum cleaner	.250 ,,

or about half the suggested future connected load figure.

Already that figure has been variously estimated at between 17 kW and 25 kW, the lower figure relating to this country (see several I.E.E. discussions). This is probable if such things as refrigerators, washing machines, and similar apparatus are left out of account, but only first cost will rule them out, not convenience, which is again accented as the immediate domestic pulling point.

Should the reader question the necessity for certain of the items cited, he must remember that the house is considered to be quite "all-electric,"—no coal or gas whatever being used. Further, the effect of the new law relating to foodstuffs cannot be ignored, as it is probably only the thin end of a powerful wedge. Nor can the constant upward tendency of the general standard of living be neglected. Each of the stated items has only been included in the light of some years' experience in a large city.

Average power consumption figures have been taken. Makers are so diverse in their power requirements for any given type of utensil that average figures, indeed, afford the only possible basis. Thus, while .95 kW of lighting is fairly definite, and the 7-kW cooker is almost universal, radiators and fires to heat the same cubic space may vary between 3.5 kW and 6 kW according to type. Allowance has been made for five portable 1 kW radiators arranged two in the drawing room, two in the dining or living room, and one for bedroom use, to be supplemented by one of the others if and as necessary. Experience shows the greatest convenience to result from this arrangement.

A point arises in connection with the cooker. The most modern cookers utilise enclosed, or solid type boiling rings, and these are rated at about 10 per cent. less wattage than for the older open type. Further, the new rings cook the same amount of foodstuffs in but 60 per cent. of the time taken by the open rings. Hence the total power consumption is very appreciably less than obtained hitherto, so that 7 kW might be thought an outside figure. For some areas this may hold However, a decided inconvenience in the old cookers is the lack of a *third* boiling ring. The demand for a third, low-power boiling ring now becomes insistent, and it is gratifying to note that some makers are incorporating the extra ring in their latest products. With more efficient boiling-ring construction, and, particularly, much needed improvement in the (heat) insulation of them from the top plate of the cooker, it may be presumed safely that in the near future three boiling rings per cooker will be the regular feature, and these rings will not consume any more power than is now taken by two. Thus 7-kW cooker maximum demand is a reasonable figure.

The geyser type of water heater is not included. As a station load, it is not regarded with favour, the ideal for domestic purposes being an all-night automatically heated and well lagged tank. The very large improvement in station load factor with many such tanks as connected night load must oust the geyser ultimately for most domestic purposes. As it is, the storage tank in conjunction with a kettle and an electric wash-boiler suffices amply for usual needs. For washing greasy dishes, it is usual, and indeed, proper, to fill either the kettle or the wash-boiler with the requisite amount of water already made hot in the storage tank, thereby connecting the intermittent water-boiling load for the shortest possible time. Such an arrangement is advantageous to both station and consumer. Two kilowatts of night load for water storage is thought to meet most needs, although for bathing, a booster heater of 2 kW is sometimes necessary. Some comments are made later on this point.

The coffee jug and child's milk heater have already made great strides, the latter especially proving of very considerable value in the early morning hours where young families have to be attended to. Power here again varies widely with make (and also size).

The toaster is likewise a great convenience, although economy sometimes results if the cooker grill is used. Generally, however, toast made under a grill is less satisfactory than that made in an enclosed receptacle designed for the purpose (which method, by the way, has medical approval).

The undeniable convenience of the table hot-plate is already reflected in its sales, although were ovens used properly, it could be done without. Unfortunately perfection on both sides of the house being the exception rather than the rule, an auxiliary is rather necessary to take care of "lost my train," "detained at the office," &c. With a cover over the foodstuffs, 200 W is sufficient to keep most articles palatably hot after removal from the cooker.

The bed warmer begins to be appreciated. It is a great convenience to have no "skittling" with hot-water bottles, red flannel, and so forth. Incidentally, as a night load, even though a small one, it is valuable to the power station. The principle of "many pennies to the pound" is too important to be neglected where night load is concerned.

The iron needs little comment, except perhaps that its future size is likely to increase rather than decrease. The beautifully smooth action of the electric iron lends itself to a rather heavier iron being used, with its corresponding advantages.

The wash boiler is a necessity, as will be seen from the above remarks about geysers and, like the storage tank, it may require an auxiliary heater of an extra kilowatt.

The refrigerator is a new thing for domestic use, but it must, in time, become essential. The tendency of all legislation is towards the sale of "natural" foodstuffs only, which keep but for a short time, and, while a point of controversy arises as to whether the home or the grocer's shop will contain the refrigerator, preference has here been given to the home, having regard, primarily, to convenience. Power consumption varies according to type, compressor apparatus naturally taking considerably more power than the purely thermo-chemico-static type. Probably the latter will find favour on account of first cost, and a low power figure has therefore been taken.

The last three items belong to my lady's perquisites. Has any engineer the temerity to doubt the future demand for these articles? The violet-ray apparatus may be slower in gaining appreciation than the others,

but to draw attention to the fabulous amount of money spent by womankind on hairdressing and beauty culture is surely sufficient answer.

The lighting load figure is not high, having regard to artistic sense, and the certain raising of the general standard of living and illumination all over the country.

Certain loads cannot be properly reckoned as regular daily features. These are (1) provision of water for baths, which, with a household of four, may be taken as necessary every second day; (2) water for clothes washing, &c., which involves the use of the extra heaters in the boiler and storage tank, and also the use of the washing machine; (3) the fan, which is very intermittently used in this country and of less account than any of the other loads; and (4) the iron, used on an average not more than twice weekly. Individual personal characteristics reflect upon these loads more than anything else, and it is therefore difficult to allocate to them a definite time per day. It is quite conceivable that they may all come on together. Their approximate position on any day's load curve, however, is indicated by the dotted lines in the diagram, two alternative times for bathing being shown.

Thus the suggested connected load could hardly be termed grandiose. Criticism of it must vary, depending upon the customs and habits of the reader. A South Wales reader lives differently from a London or Glasgow reader, and his ideas of necessity and convenience differ accordingly. But it is thought that the suggestions will cover fair average instances.

How are these loads disposed throughout twenty-four hours' working?

The load diagram on p. 630 has been computed on the basis of some years' observation and experience of a number of users residing in "all-electric" homes, and a measure of its accuracy may be gained if the cessation of the properly mid-day load at 1.15 p.m. be noted. The daily load curves of most large power stations in this country show very definite clefts about 1 p.m., *i.e.*, when most industrial establishments have closed down for the mid-day meal. (Typical curves for the Dalmarnock station are to be found in Vol. 64, p. 294, *Journal*, I.E.E.) The two times tally sufficiently well for the present comments. The diagram refers to an average spring day.

Probably the most striking point is the exceptional irregularity of the loading. From the disturbance caused by baby at 2 a.m. until lights out at 11.30 p.m., the succession of peaks is quite unique. The main trouble (if such it may be called) originates in the cooking load and in the use of the smaller intermittent loads, the latter having a very disturbing effect. The staple loads are the water-storage load during the night, and the radiator load during the day, the latter being broken only from 3 p.m. to 4.30 p.m. It is conceivable that in many instances the radiator load is rarely broken at all.

The diagram might have been improved had it been built upon these loads as foundations, but, originally, it was particularly desired to examine the cooking load conditions, and these were first plotted. The final shape of the curve holds, of course, either way.

The cooking load (which includes kettle and coffee jug, &c.) is very complex, as will be seen from that part of the curve representing the mid-day position, in which the constituent parts of the load have been fully indicated. The actual switching operations here are as follows:—

11 a.m.	Large boiling ring	...	full
	Kettle	...	on
11.15 a.m.	Kettle	...	off
11.30 a.m.	Large boiling ring	...	med.
	Small boiling ring	...	full
	Kettle	...	on
11.45 a.m.	Oven	...	full
	Kettle	...	off
11.50 a.m.	Small boiling ring	...	med.
12.00 noon	Large boiling ring	...	low
12.15 p.m.	Kettle	...	on
12.20 p.m.	Grill	...	full
12.30 p.m.	Small boiling ring	...	low
	Kettle	...	off
	Coffee jug	...	on
	Oven	...	med.
	Table hot-plate ...	...	on
12.45 p.m.	Large boiling ring	...	off
	Oven	...	low
12.50 p.m.	Grill	...	off
1.00 p.m.	Small boiling ring	...	off
	Table hot-plate ...	...	off
1.05 p.m.	Oven	...	off
1.10 p.m.	Coffee jug ...	...	off
1.30 p.m.	Kettle	.	on
1.45 p.m.	Kettle	...	off

The remainder of the diagram has been built up similarly.

A probable danger point is 7.30 a.m., at which time circumstances may arise to cause annoyance. By far the largest peak occurs here, as will be seen from a case in point. A friend converted his establishment by degrees to one almost wholly electrical. That is, he installed a cooker, followed it later by a radiator, and so on, some months elapsing ere the change-over was complete. One morning he decided to have a hot bath immediately after rising. The weather being frosty, all the radiators were in use. Practically the full connected load was switched on at one time. The cable drop was sufficient to delay the cooking operations by about fifteen minutes, likewise the hot bath, which cost the bather his train and his temper. Conceivably, the point could be of importance in a given area, and, it is thought, to avoid the cost of excessively heavy main and sub-cables to cope with a very short high-peaked load, the time switch on the hot-water tank might be arranged to switch in the booster heater from, say, 6.30 a.m. to 7 a.m. At the appropriate time the cable would then be free to take the normal cooking and heating load.

The morning load appears to be the least favourable. The mid-day load is much better, and the evening load between the two. (Where late dinner is the rule, the mid-day and evening loads shown will, of course, be interchanged.)

On the whole, the domestic load peaks occur synchronously with the station load clefts, which is satisfactory. But the domestic load itself leaves room for improvement. Thus its own load factor is not brilliant, and there is scope for at least two methods of improving it.

One is to alter the rationale of cooking; rather a tricky job from the human nature point of view, but the Soyer cooker points the way. A reversion to the "paper-bag" or "hay-box" method would be welcome from both the load factor and the consumer's points of view. Thus, if the morning's breakfast were put into an electric "hay box" or similar arrangement, and heated by the *night load*, inestimable advantage would accrue all round. The consumer would be saved much trouble in the morning, and given very little last thing at night. The food would be cooked ideally from the medical aspect, power would be very cheap, and station load factor would benefit enormously.

The idea is far from being impracticable. All that is necessary is a thermostatically controlled "hay box" and a time-temperature cooking chart. The former is an easy practical proposition, and the latter is already made quite feasible in an ordinary electrically-heated oven. The suggestion is made in all seriousness, for the question of load factor is vitally important. Electrical education ought to be directed with all the energy possible toward the attainment of cheap power through the improvement of station load factor, more particularly in view of the enormously costly transmission network about to be erected. From some years' experience and observation of electric cooking operations, the writer considers the electric "hay box" to be a perfectly practicable proposition, particularly when the

feminine mind realises the large decrease in power bills which would result from its use.

The second means of improvement lies in the sale of "convenience" apparatus designed to be used between the cooking peaks. The vacuum cleaner is an example, but is, in itself, a peak load, and therefore not of the best. To those who can afford them, low-power electro-decorative effects point the way here. The psychology of decoration is slowly widening in appreciation. A variation of colour "tone" here, a sudden contrast there, and so on, are easily obtainable by suitably disposed low-wattage tinted lamps, bowls, festoons, &c. True, at present they are luxuries, but with power price reduction, time will alter that. The subtle, but vital, influence of colour upon general health is being recognised, which, in itself, is almost sufficient. Already it is quite usual to dine in a room in which the colour scheme is peculiarly appropriate. No one would partake of a heavy meal in a drawing room. After the evening meal, to recline for an hour in a quiet colour atmosphere not only pleases, but indicates good psychological sense. A visitor to any electrical showroom, on a brilliant summer day, is, far from being disconcerted by the sunlight, deliberately, if sub-consciously, encouraged by discreet interblending of sunlight and coloured electric light.

Such a load, small in itself, but large in the aggregate, would, if judiciously used, effect a great improvement in load-factor conditions.

Finally, the diagram clearly shows that the peaks, exclusive of cooking, are the result of the summation of the small intermittent loads. This is to be expected as a result of convenience, and will be difficult, if not impossible, to eradicate. However, if in the aggregate they tend immediately to the cheapening of power (and it is confidently thought that they do), this in turn will be followed by a more general use of long-period loading, such as lighting, radiators, clothes-drying apparatus, towel rails, &c. When these become more universal, the intermittent non-cooking load peaks may be neglected.

The Trade Unions Bill.

Illegal Strikes; Picketing; and Political Funds.

By W. ERIC JACKSON, LL.B., Barrister-at-Law.

THE Trade Unions and Trade Disputes Bill may be expected—like most short Acts of Parliament—to provoke long and bitter discussion. The aim of the Bill appears to be to restore the strike weapon to its original position and function, namely, as a mode whereby employés may withdraw their labour pending a satisfactory settlement between themselves and their own employers. The Bill makes illegal all sympathetic strikes and strikes in trades in which there is not at the moment a trade dispute. The use of the strike as a political weapon, or as a direct road to social reforms in general, is forbidden. The necessity for such provisions in the Bill has, in the opinion of many, been apparent from the industrial events of the last few years.

During recent strikes the right of peaceful picketing or peaceful persuasion—conferred upon workers by the Trade Disputes Act of 1906—has more than once been disregarded or evaded in such a way as to nullify the protection given to non-strikers. Moreover, the refusal to strike has been visited with dismissal from the Union or other penalties imposed by the Union ordering the strike.

Sections 2 and 3 of the Bill are framed to remedy these matters as regards strikes which the Bill makes illegal. An "illegal strike" is one which has an object besides the furtherance of a trade dispute, and which is designed to coerce the Government or intimidate a substantial portion of the community. Hence a strike in an industry in which there is no trade dispute is illegal if it is meant as a political move to frighten the public. If it is not so meant (and it is difficult to see what sympathetic strikes will not be so designed) it is not "illegal," but it is unlawful in the sense described by Sir John Simon at the time of the last general strike—namely, dismissal from the Union cannot follow a failure to strike, and damages may be claimed by the employers against the Union calling the strike.

An "illegal" strike under the Bill must not be visited with penalties upon trade unionists who refuse to take part; they are to lose no benefits and may take any legal action against their Union to enforce their right to continue to be members and to receive benefits. The latter provision extends to all strikes *past and future*; hence any person expelled from a Union through failure to strike in May last will be able to claim reinstatement or damages.

It is to be illegal for anyone to contribute funds towards any "illegal" strike, and any person taking part in or supporting such a strike is visited with a fine not exceeding £10 or three months' imprisonment, which in special cases may be anything up to two years.

Under the Act of 1906 and the Emergency Powers Act, 1920, protection was given to persons who committed acts in furtherance of a trade dispute even though such acts might otherwise have been illegal. Such protection is taken away as regards "illegal" strikes.

Peaceful picketing is not prohibited by the Bill; but stricter provisions are made to ensure that picketing shall be peaceful in the proper sense. No intimidation of any kind is to be allowed. By intimidation is meant not only apprehension of physical violence, but fear of mental injury, boycott, or exposure to ridicule. Picketing is to be allowed so long as the number of persons engaged is not such that they obstruct or intimidate. By a special clause, watching and besetting any person's house is punishable with fines up to £20 or imprisonment up to three months.

As regards the political fund of a Union, the rule is to be "contracting in" and not "contracting out," as it now stands. Where a member contracts to contribute to the political fund, his fees are to be paid separately from his other subscription, and only the amount specifically subscribed to the political fund is to be used for political purposes. The rules of each trade union are required to be altered to conform to this provision.

Section 5 applies to permanent civil servants. They must not in future belong to a Union which is in any way given to political objects. But if a civil servant already is a member of a Union which is to give benefits on his death or disablement, he is not to be required to resign, provided he has been a member for the last six months. And civil servants who have work outside their

Government duties may belong to any Union dealing with such outside work.

Section 6 provides that public authorities must not force their employés to join or abstain from joining a Union. Hence a Labour Borough Council or a Conservative County Council can have no influence over employés either way. And non-union workers are not to be treated any differently from union workers.

Lastly, the Conspiracy Act of 1875 (which made it unlawful for a worker to break his contract of service so as to endanger life or property) is extended to cover breaches of contracts of service which will "prevent the discharge of the functions of the authority." Hence dustmen, tramdrivers, and gas workers will be unable to strike at all except under pain of fines or imprisonment.

It remains to be seen what success the Bill will meet with, and what alterations will be made in it as criticism is levelled at it. So far the opinion in Government circles as to its success is very optimistic, and one may feel confident that in some form or other the Bill will shortly become law.

The Ordinary Engineer and his Remuneration.

A review of the conditions which have resulted in the present low salaries for the bulk of the electrical engineers in this country.

By P. B. E.

THE correspondence which has recently appeared in the ELECTRICAL REVIEW inspired in me a desire to analyse the reasons for the meagre salaries paid to highly-trained electrical engineers.

In the first place, it is unfortunate, but none the less true, that the majority of skilled technicians, whilst possessed of practical knowledge and experience, are rarely men of great executive ability. There are those in the industry who are highly paid, some who are adequately paid, and a vast majority who receive salaries quite insignificant in comparison with their attainments, and with the work on which they are engaged. What are the broad divisions governing the classification? The first class comprises men with little technical training—or with none at all—who are possessed, or believed to be possessed, of outstanding business acumen. This class is composed of those who direct and manage our companies. Sometimes they possess their posts through merit, sometimes through pure cheek, and sometimes through unblushing influence exerted by someone higher up the tree. Whatever their deserts, such men are highly, even magnificently, paid. The second class, those who are adequately paid, consists of men of outstanding technical attainments; of men having ordinary technical attainments, and a knack of presenting them advantageously, and of men with exceptional personalities or influence. These two classes can be dismissed from our consideration. If dissatisfied with their remuneration, they can easily get it raised. The third class comprises probably 90 per cent. of the technical workers in the industry, and the question of their remuneration constitutes an extremely intricate problem. This class consists largely of men with University training and wide engineering experience; of men with the engineering instinct strong in their bones; and of men who, unable to afford a University education, have taken junior posts in engineering firms, and by dint of much private study and the help of evening classes, have eventually worked their way, after the expenditure of much time, to the engineering staff. There are others with no engineering instincts, no training, and no initiative, who slowly progress until their employers think that they can be employed on technical routine work and thus be used to dilute the engineering staff. With the last named we are not concerned, excepting to agree that their elimination would be highly desirable. The remainder of the class are usually hard-working and ill-used individuals. A few of the causes of their unjust treatment are enumerated below.

(1) The Britisher has a natural aptitude for engineering, and in consequence there is an inexhaustible supply of recruits, who, eager to get their feet on the first rung of the ladder, accept salaries far below what they ought. As they progress to positions increasing in importance, their salaries rise only at an insignificant rate, due to the low salaries of those coming along behind. This "negative" effect is naturally felt all along the line until the executive posts are reached. As the number of recruits far exceeds the expansion and wastage in the industry, it follows that stagnation—both as regards positions and salaries—is the result.

(2) Salary-fixing individuals are invariably well paid themselves. At all events, they have enough to live on. They forget their own experiences on the lower rungs of the ladder—or if they remember them at all, they do so in terms of pre-war salaries. They think, in effect, "Oh, well, 'X' ought to be satisfied with £350 per annum. At his age I was only getting £400, and he *can't* be as clever as I was." What Salary Fixer, Esq., forgets is that Mr. Jones's £350 to-day is equivalent to only about £220 pre-war—a most disgraceful salary to offer to any man with any pretensions to technical ability.

(3) There is no society in existence whose main object it is to secure adequate remuneration for electrical engineers. The Institution of Electrical Engineers holds itself placidly aloof. The National Union of Scientific Workers certainly includes remuneration as one of its objectives, but fails to exercise any pressure in that direction except in one or two isolated instances. Its very existence is unknown to most engineers, and its recently-issued appeal will fail in its object, since it gives no hopes of the salary question being seriously attacked.

So far as I am aware, the Society of Technical Engineers does not claim to deal directly with this question. Its declared object is to raise the status of the engineer, believing that this method of indirect attack will lead to the desired result. It is self-evident that the engineer's status does require protection and elevation, but as a means of effecting an improvement in salaries, this method is altogether too slow. Swift action is essential if thousands are to be saved from penury.

Moreover, no society will obtain effective support until it is prepared to take swift action.

(3) The inherent nature of the engineer, who generally is modest and retiring and is possessed of a modicum of proper pride. The mere asking for an increase in salary is repugnant to him, and the idea of exerting pressure, nauseating. He takes pride in his work for its own sake, consequently the quality of his work is independent of the inadequacy of his salary.

(4) Specialisation, which, it appears, is generally regarded as an asset. Perhaps to some extent it is, but it has its drawbacks—and very serious ones they sometimes prove to be. For instance, a man may have spent several years on large machine design, but he will find the utmost difficulty in obtaining a post in any other branch of design unless he can—and will—lie scientifically and convincingly.

(5) The fact that the engineering concerns of the country are scattered over a large number of localities is a serious contributory cause of low salaries. The engineer of to-day is a specialised unit. Those firms which can employ his knowledge and experience may be located, broadly speaking, anywhere between London and Glasgow. It is a serious matter for a man with a family, and no financial reserves, to uproot his home and start afresh in a new town. He may find considerable difficulty in disposing of his house without financial loss, and in procuring another. The costs connected with his removal may, in fact, neutralise for a number of years the increased salary attached to his new post. Employers are well aware of this fact, of which they take full and unfair advantage.

(6) The collaboration which exists between firms engaged on the same class of work. Although it is vigorously denied, it is a fact that certain firms will not engage a man unless his present employers are prepared to release him.

These are a few of the reasons why the ordinary engineer receives a salary on which he can barely exist, let alone educate his childen. The remedy can be summarisd in one word—education—and elucidated in very few more. The full power of the Press, both technical and public, must be enlisted. The coming generation must be shown the true position: that hoary fable of the many "plums" waiting for suitable men must be ruthlessly exploded; young engineers must be taught that the acceptance of salaries so low as to deserve the appellation "nominal," will affect not only the whole of their own careers, but those of the whole profession. Employers must be educated. They are more in need of that than are most of their employés. If they will not accept education, it must be forcibly thrust upon them. The Americans have found that high production follows high remuneration. It is time our employers were asked to experiment in the same direction. They can begin by paying fair salaries to their engineering staffs. Whereas one engineer is but a unit, the whole body, when united, could bring the employers into line with a relentless jerk in the course of a few weeks. The use of force, or forcible methods, is to be greatly deprecated, and should only be used when employers persistently refuse to act justly, after having been shown that the salaries they pay are unjust. The query arises whether employers are not, even now, fully aware of the inadequacy of the remuneration of their technical staffs. There are many who believe that they are; what employers probably do not know is that, beneath a placid surface, the whole technical side of the industry is seething with unrest. It would be well, as a starting point, if the Institution of Electrical Engineers could be galvanised into educating the multitude of employers in its own ranks. Of course the idea of that august body being galvanised by anything short of an earthquake strikes one as ludicrous, but, after all, though the awakening might be a matter of great difficulty, it is by no means impossible. Education must also be carried to shareholders, so that they may realise that the concerns they own are dealing most unjustly with one branch of the employés. The public also must be shown that it is both wrong, and uneconomical, to starve that section of the community on which the prosperity, and indeed the very existence, of the country so largely depends.

It is only from continuous, active, and public pressure that any beneficial results can be expected. When engineers realise their power as a body, they will find means of forming an organisation to protect their interests and be under their control. On that day the injustices to which we are now subjected will be on the way to being rectified.

Electric Water Heating.

A consideration of the possibilities of load-factor improvement in connection with the electrical thermal storage of water with time control by motor-meter switches.

By J. W. MEARES, C.I.E., M.Inst.C.E., M.I.E.E.

IN the ELECTRICAL REVIEW of March 4th, Mr. E. E. Sharp expressed the view that time-controlled water-heating will eventually help to fill up the hollows in our load curves—a possibility that the present writer has been putting forward for years without much effect. It has been done successfully at Simla, in India, even without time-switches, by voluntary co-operation between the supplier and consumer; but that is too much to expect here, so that it comes down to the bed-rock cost of the *additional* units generated and the cost of the time-switch. So long as clock-controlled time switches are essential their cost will be a serious obstacle to progress, though of course any great extension of their use would cheapen them.

Any one who has been much about the world knows that we British, whether rightly or wrongly, are universally debited with the characteristic of waiting till the other fellow has done it before taking action ourselves. At present, if the politicians are right, we are entering upon a new golden era of "cheaper and more abundant electricity," and we all hope they *are* right, whether we agree with their panacea or not.

Now when all has been said about grids and standard frequencies and super-stations, the plain fact remains that in improved load-factor lies the only real prospect of cheapening supply; because the additional output spreads the standing charges without increasing them, while only enhancing the running costs fractionally. (Our present-day central station load factors average about 20 per cent. only).

This has long been recognised, and many tariffs are specially devised to benefit the most useful class of

consumer; but the correspondence in the lay Press from our masters, the public, which knows nothing of load factors, but pays for the supply, shows that there is much high feeling about the discrepancies in the ultimate cost of a unit in adjoining areas. The grievance is a real one, an *argumentum ad pocketum*, which no amount of perfectly correct technical explanation will in any way allay.

Of late years the more progressive undertakers have been busy improving their heating and cooking loads by means of special tariffs, and at the same time improving their load-factors and reducing their total costs per unit generated. It is perhaps not always fully realised that if the public responded, and really boomed these special supplies, they would soon become predominant and swamp all other uses; in which case higher, rather than lower, rates would have to be charged in order to redress the balance. An oft-quoted example, in a "Report on the Heating of Houses" by the Hydro-Electric Commission of Ontario, shows that if the 80,000 houses in Toronto alone were electrically heated this would require eight times as much power as the present total demand of that City; so that heating would have to bear the whole cost and provide all the profit, leaving other uses of power as the by-products.

Up till now domestic water-heating, except in a few places supplied by water-power, has been considered prohibitive in cost; and, if it were not so, the Ontario objection would still apply if it became universal. Economic conditions, however, make it certain that there is no immediate danger—or shall we say prospect—of any inordinate run on our stations for any form of heating. Therefore, the more such loads are developed as paying loads, or even as overhead-cost-spreading loads, the better.

Now the diversity factor of cooking loads is generally bad, and that of house-warming loads indifferent; the peak times of the former necessarily coincide as a rule, and the demand for heat varies with the climate and so is fairly uniform in any one area. And when power is wanted for these purposes it must be available; no one will alter his hour of breakfast or dinner, or sit in cold storage, in order to improve the load factor of one undertaker (and perhaps the business of another) and to obtain a slight reduction in the tariff.

With water heating it is different. Hot water must, it is true, always be available, but with properly lagged tanks it can be kept hot for hours with the power cut off—and, unlike a chop, with little deterioration. Whereas electric cooking and house warming require the full power (or nearly so) to be in use during the whole period of operation, and no power at other times, it is otherwise with water heating. Here, with properly designed thermal storage, there can be a uniform consumption of power throughout most of the 24 hours, regardless of the time at which hot water is actually drawn off. This is, or could be made, an immense advantage to the suppliers, as the amount of plant—and capital—per kWh sold for the purpose becomes the minimum.

In order to obtain the full advantage power must *not* be used throughout the whole 24 hours; it must be cut off at times of peak load. If the morning peak is much smaller than the ordinary evening peak, the latter alone need be considered; if there are two or more comparable peaks, all must come into the reckoning. Now it is abundantly clear that the consumer cannot be induced or trained to cut off the water-heating apparatus before the peak and to restore it afterwards, so if it is to be done at all it must be done automatically. The advantages of so doing it, both to undertaker and consumer, are incalculable; and considerable capital expenditure would be justified in supplying a reliable time-switch in each installation. Practical examples are always useful in these cases. Let us assume a small house requiring 110 gals. a day at 100 deg. Fahr. and it will be found that with modern apparatus this requires some 5,500 kWh per annum. If a time switch costing 60s. were employed, 15 per cent. on its cost would amount to 0.02d. per kWh: and, as the prime cost would be fairly independent of the consumption, this figure would be far less in large houses. The gain to the undertakers in additional output without increased maximum demand would clearly be far more than this sum, and they could install the apparatus free of vexatious rent charges; but we are not progressive in such matters.

It may be assumed that a charge of a halfpenny a unit *over all*, coming to nearly £12 per annum for 5,500 kWh, would be near, if not beyond, the limit obtainable from a small householder; and at present there are not too many stations in which the cost of fuel alone is less than this, though it would be less for *additional* units taken by themselves. Still, we must look forward to better times, while reckoning that from both the average supplier's and the average consumer's points of view a halfpenny may prove practicable.

But is it necessary that a time-switch costing even as much as 60s. should be required? Some years ago, in a case where an immediate and assured market existed, the present writer addressed several leading manufacturers suggesting that a cheap and efficient time-switch could be evolved on the basic lines of an ordinary motor-meter, which at the pre-arranged time would operate a relay to open and close the circuit; he was told that it could not be done. The difficulty is said to lie in the fact that the best of these meters are bad timekeepers, and that only a clock is effective. The permissible error of motor meters, as laid down by the B.E.S.A., is 2 per cent. either way at from one-fifth to full load; that would be half an hour a day, and no such error is allowable. But over so wide a range there is necessarily a large departure from straight-line accuracy; and under service conditions, for which the B.E.S.A. caters, the meter is stationary and cold for hours in the night, and varying its load and temperature without cessation at other times. Surely if the motor were designed for *constant operation at one load only*, across the supply mains, the rate of rotation would necessarily be practically uniform? (The slight changes in the supply voltage would average out in the course of a day). At any rate, has any maker ever tried this out? The writer can find no evidence that any one has put out a fiver-sprat in definite research for a way of catching this million-whale.

As matters now stand such a motor time-switch could be reset once a quarter, at the time of meter reading; an error of ¾ hour in that time could be compensated for by adding it to the switched-off period, for it would be definitely either a gaining or a losing error, and not an erratic one. This would involve an inaccuracy not exceeding one-tenth of one per cent. in the rate. Perhaps that is too much to expect. But the time of peak load also varies with the seasons, so that even with a clock-switch it would be necessary to reset the gear from time to time. It would seem as though, in order to improve the load factor by a matter of 20 to perhaps 40 per cent. it would be worth while to have all the time switches set by hand once a month, or even once a week; large interests are at stake when a single small house may be worth 5,000 extra units. Clearly, when starting the system each individual switch would have to be adjusted to the mean pressure conditions of its locality; but that is merely a matter of changing a wheel in the gear train after a week's trial.

The Electrical Development Association and kindred bodies might think over all this with advantage, for a fraction of the money and brain power spent on boosting electric cooking would probably show a far greater eventual return.

[The Warren synchronous motor—a simple little device, which is widely used in the United States for driving electric clocks—could perhaps be used to close a switch at, say, 9 p.m. and open it at 5 a.m., on a.c. circuits, all the year round, without attention (see Electrical Review, February 18th, 1927, p. 276).—Eds.]

An Automatic Telephone Switch.

A quick-acting switch which can be manufactured on a large scale very cheaply: it can be constructed and arranged in a very simple manner to act as a line-finder, call-distributor with many outlets, group selector, or final-selector.

ALTHOUGH the Strowger switch is used extensively in telephone exchanges, there are others which differ considerably from that pattern, in that they are power-driven. Many rotary switches are thoroughly efficient in comparison with the Strowger type; nevertheless, they cannot be employed in the simplest manner as line-finders, call-distributors, group-selectors, and final-selectors, as desired. For example, if connected as line-finders in installations whereof the groups contain 100 subscribers each, then, in the case of most of them, several switches must be arranged in parallel with one another for each junction; and, if the switches have a 50-point contact bank, the contact arms must also be crossed, if the calling line is to be connected through quickly. Those switches that have 100-point (and larger) contact banks often need a long time to reach a calling line; a "quick-acting" switch is capable of testing with certainty at least 100 individual lines in succession in less than 0.5 second.

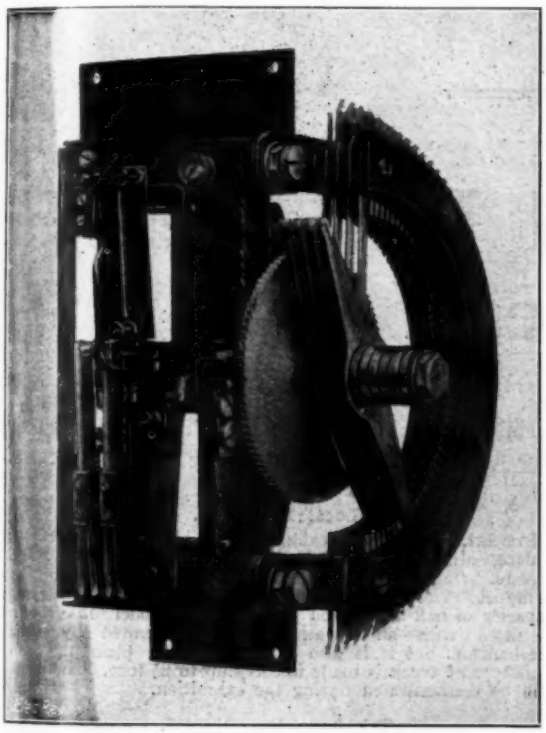
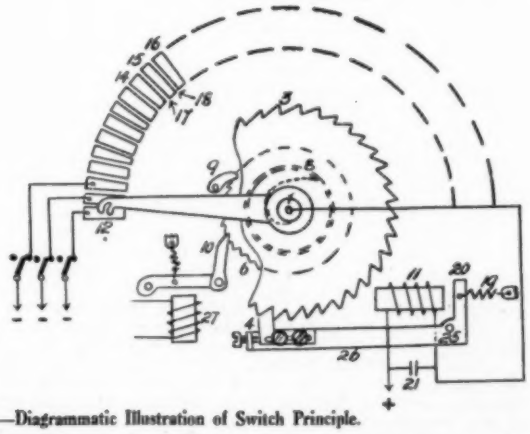


Fig. 1.—Quick-acting Telephone Switch.

That simplification of apparatus should be aimed at, especially by devising a less complicated and more efficient type of switch, has always been recognised, and in this connection our attention has been drawn by Dictograph Telephones, Ltd., to a quick-acting switch (fig. 1), the principle of which is indicated by figs. 2 and 3. It has a spindle 1 on which the brushes are mounted, insulated, only one brush 2 being shown; a sleeve 5 is rotatably mounted on the spindle, which carries at its upper end a ratchet wheel 6 and at its lower end a spring box 7; one end of the spring 8 is connected with the spindle and the other end with the casting of 7, so that when the spring-box is rotated in the direction of the arrow the spring 8 tends also to rotate the brush spindle in the same direction. The consequent winding up of the spring is effected by a propelling pawl 10 oscillated by an electromagnet 27, the pawl rotating step-by-step the ratchet wheel 6 attached to the spring-box until the spring 8 is completely tensioned. Rotation of the wheel 6 in the reverse direction is prevented by a locking pawl 9; the brush spindle 1 is held against the action of the spring 8 by stopping pawl 4, which engages in the teeth of a wheel 3 secured on the spindle.

In order to set the brushes 12 on any bank contact the stopping pawl is moved out of the wheel 3 by the control magnet 11, and so soon as the brush leaves the bank contact lying in front of the desired bank contact the magnet is de-energised so that the pawl 4 again engages the wheel 3 and stops it. The current passing through the magnet flows through the brush 12 and the bank contacts wiped over by it; all the bank contacts up to that one (for example, 15) whereon the brushes are to stop are connected with the battery, and the adjustment of 12 in relation to the bank contacts and of 4 (which is movable on the armature lever 26) in relation to the teeth of 3, is such that the point of the pawl at the moment when the brush just leaves bank contact 14 (lying in front of the desired bank contact 15) stands in front of the tip of a tooth of the stopping wheel 3; thus the total time which the brush needs to wipe over the desired bank contact 15 and the air gap 17 separating it from the adjacent bank contact 14, is obtained for the dropping of the stopping pawl 4 into the correct tooth slot; the time of dropping of the pawl 4 can be adjusted by regulating the tension of the armature return spring 19. An important means for the shortening of the time of falling of the armature 20 (*i.e.*, for the rapid engagement of the stopping pawl 4 in the correct tooth slot) is the condenser 21, which reacts on the magnet coil 11 and can be connected in parallel with the coil 11 or the brush 12; by this means the current in 11 on opening its circuit is not only made to decrease quickly, but also up to a certain degree to reverse its direction, the residual magnetism of the control-magnet core being obliterated. It has been found in practice that the switch stops its brushes, or catches with sufficient operating certainty, when the brushes wipe over their bank contacts at a speed of 300 contacts per second: a 100-point line-finder of this construction, therefore, reaches the 100th bank contact furthest removed from the position of rest of the brush in one-third of a second, so that the use of a dialling tone (which indicates to a calling subscriber that his line is connected through to the next selector, and that consequently he can operate his dial) can be dispensed with.

When working as a line-finder for subscriber groups up to 50 lines, two groups of brushes displaced by 180 deg. are used, of which each reaches the beginning of the row of bank contacts before the other group of brushes leaves the last bank contact of the same row. In groups of 100 lines the groups of brushes are also displaced by 180 deg., but are so displaced that when the one group of brushes has wiped over 50 contacts, the other group wipes over a further row of 50 contacts.



Figs. 2 and 3.—Diagrammatic Illustration of Switch Principle.

When working as a group selector, the contacts are divided into groups; at the beginning and centre of each are embracing a group are located controlling bank contacts, and between each such pair is a third long intermediate contact, which

may be composed of several ordinary bank contacts connected with one another. In each arc are located the bank contact sets for the junction lines leading to the next group selectors, or the connectors: the dimensions of each arc jumped over by the brushes can be selected within limits merely by connecting, as initial and central contacts, such bank contacts whose distance from one another is greater or less. The possibility is thus obtained of making the number of junction lines in the different trunks proceeding from the group selector different, without leaving bank contacts unoccupied.

When arranged as a final selector or connector, the long or "ten" steps of the brushes are determined by an inner row of bank contacts which is wiped over by a brush, whilst the short or "unit" steps are determined by outer bank contacts wiped over by another brush. The long steps may, as in the case of the group selector, be of different lengths, that is to say, any one may correspond with a bank contact arc which contains 10 or more lines; this is very valuable for multiple connections.

It is declared that the selector will last for at least 20 years in a busy exchange. The soldering tags of its contact bank are so formed that the contact banks can be multiply connected by straight wires or cable bands. In the group and final selecting stages it is contended that about 20 per cent. of the present selector cost can be saved by using the new quick-acting switch, which enables a subscriber, after taking down his receiver, to operate his selector immediately, and makes it unnecessary for him to first wait for a signal. A new starting circuit is employed, and is so arranged that several subscribers calling at the same time can be connected through simultaneously. The new switch also makes economies possible in the pre-selecting stage: the number of line-finders employed in the first pre-selecting stage can be reduced, and, in comparison with the 100-point line-finders hitherto known, it is not only quicker, but also cheaper. Without splitting the multiple, over-lapping, or staggering the multiple connections on the contact banks, which make inspection difficult, calls can be distributed perfectly uniformly on group selectors, which may be as large as desired, so that the greatest utilisation of all switches can be readily obtained.

The switch described, the invention of Mr. Fritz Aldendorff, has already been incorporated in several private automatic branch exchanges placed on the market by Messrs. Dictograph Telephones, Ltd.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

An E.D.A. Film Display.

The British Electrical Development Association proposes to run a display of E.D.A., British and American kinematograph films at Australia House on May 3rd. About 200 seats will be reserved for members of the Electrical Association for Women, the remainder being available for persons engaged in the electrical industry.

The Department of Overseas Trade.

The proposed "termination of the separate existence" of the Department of Overseas Trade has called forth protests from many quarters. Col. F. V. Willey, ex-president of the F.B.I., characterised the proposal as a "grave mistake," and expressed the hope that there would be no curtailment of the activities carried on by the Department, and also that the Foreign Office would not be allowed to interfere with the work, which, he said, it had never regarded with a sympathetic eye. Sir Stanley Machin, ex-president of the Association of British Chambers of Commerce, said that the Department was a live and useful body of great value to exporters, and nothing should be done to impair its efficiency. Mr. H. T. Humphries, general secretary of the Incorporated Society of British Advertisers, stated that the Department provided a constant stream of information called for by the members of the Society, and suggested that it might be made a trading department charging for its services like the Post Office. Mr. Churchill himself admitted that the transfer of work to other departments would not in itself effect any large saving; the extent to which functions could be discontinued would be examined in detail when the necessary legislation was presented to Parliament.

Lord Sandon, M.P., according to *The Times*, put down a motion in defence of the Overseas Trade Department in the following terms:—That this House regards with alarm the Government's intention to discontinue the separate existence of the Department of Overseas Trade, in that, while involving a negligible, if any, apparent saving in expense, it will not prove an economy, but is bound to create a loss of revenue to the State, due to the lack of prosperity in industry, resulting from the loss of new markets and trading openings such as are constantly being discovered under the auspices of the Department; and that the House believes this to be owing to the Department's unique atmosphere of vitality, enterprise, and helpfulness, attributes which of necessity and in fact cannot be found in any other department, and which would certainly be lost if it were placed under one of the older departments, a fact fully appreciated by all sections of industry in this country, for the benefit of which its submergence is urged.

Local Exhibition.

STEPNEY.—An electrical exhibition is to be held at the People's Palace, Mile End Road, E., from April 29th to May 7th. Messrs. Wingrove & Rogers, Ltd., intend to exhibit a "Midget Whippet" electric battery truck. This truck has a carrying capacity of half a ton, and the particular model to be shown is fitted with an elevating platform operated by hand mechanism, but it is also supplied with a plain platform. This type of truck is made to carry up to 2½ tons. The truck will be demonstrated during the exhibition.

Telephone Development.

A further publication has reached us from the Controller of the London Telephone Service extolling the advantages of the telephone as "The Speediest Way of Doing Business." Particulars of trunk call charges are given, notably the fees for regular daily use. On the back of the pamphlet the use of extensions is advocated; the daily cost is small and installation is free.

An Economic Survey.

Among the documents prepared for presentation at the International Economic Conference which is to be held at Geneva in May, is a "Summary Memorandum on Various Industries." This is a study of the principal industries of the leading industrial nations and in a broad way links up with the B.E.A.M.A. survey which is reviewed elsewhere in this issue. It differs, however, by reason of its wider scope and more general nature. It is interesting to note that many of the main conclusions arrived at agree with those of the B.E.A.M.A. report.

Lighting in Schools.

Realising the importance of adequate and correct lighting in schools, the Cardiff Corporation is at present engaged in re-fitting the schools in its charge with up-to-date lighting equipment. Mr. C. G. Morley New, the city electrical engineer, is acting as consultant and the work is being done by local contractors to his specification. Thirteen schools have already been dealt with and seven of these have been equipped wholly with B.T.-H. "Veluria" shades, three with "Holophane" shades, and three with mixed types of reflectors in conjunction with obscured gasfilled 60-W and 100-W lamps. The "Veluria" shades have an excellent appearance, both by day and by night.

Indian Electrical Imports.

The imports of electrical equipment into India during January last attained a value of 4,300,000 rupees, as compared withonly 1,627,000 rupees in the first month of 1926.

Engineering Employés' Wages.

On April 12th a conference of representatives of the engineering trade unions and of the engineering employers was held in London. Mr. J. T. Brownlie, president of the Amalgamated Engineering Union, presented a request that the employers would again consider the question of an advance in wages in the light of the improvement which had occurred in the position of the industry since the unions decided to postpone further action in the matter last August. Mr. Brownlie reviewed the course of the previous negotiations and then mentioned specific examples of the increased business which the industry had recently secured. He pointed out that his union's records showed that the percentage of members who were unemployed had fallen from 12.80 in December to 8.06 at the end of March. The wages of skilled engineering workers, he said, were totally inadequate and compared very badly with those paid in other industries. That fact was driving skilled men from the country and preventing boys from entering the industry. Sir Allan Smith, in expressing his appreciation of the way in which Mr. Brownlie had presented his case, promised that the question would receive the earnest consideration of his federation. In accordance with its rules, the district associations would first have to be consulted. It was decided to resume the conference on May 19th.

Hopkinson's Display at Blackpool.

Engineers notoriously can never get away from "the job," even when on holiday, and this propensity is catered for, so far as northern engineers are concerned, by Messrs. Hopkinsons, Ltd., of Huddersfield. They have again opened their display at Blackpool for the season, and a view of this

Engineering Exhibits at Blackpool.

is reproduced herewith. The display is purely an exhibition of the company's latest products and not a sales office. A complete range of safety boiler mountings and valves for the highest pressures and superheats is on view, and most of the exhibits are in section to enable a complete examination to be made.

The Timber Market.

Our timber trade correspondent writes that during the past month the market for softwood timber for house, packing-case, and general construction work has shown a firmer tendency, after easier times, owing to the good consumption, leaving stocks comparatively light. The opening of navigation in Northern Europe next month, however, will release very large quantities for immediate shipment, but as these have been purchased at higher rates than winter supplies, the market is expected to continue firm. Hardwoods of American descriptions keep in good supply, owing to increased shipments, but forward business remains firm, and spot consumption is increasing. For mahogany and other hard and fancy woods in the log, stocks in first hands are light, and rates firm for all descriptions. With the general increase in house-building and other industries the timber trade appears to be in for a very busy time, hence sellers will have the market a little more in their favour than for some months past.

The Italian Radio Market.

The United States Consul at Milan says that a good market existed for crystal sets immediately after the opening of the Milan broadcasting station in 1925, but the demand fell to inconsiderable proportions. Now it is proposed to erect a new station near Milan, and this is expected to open up a new and larger market. A great deal of interest has been shown in valve sets; the cheapest are of Italian make, but German, British, French, and American sets are available.

Australian Electrical Imports.

The imports of electrical machinery into Australia during January last attained a value of £589,000, as compared with £577,000 in the corresponding month of 1926.

New Italian Companies.

Among the concerns recently formed in connection with electricity supply in Italy are the Società Elettrica Buonalbergo-Casalbore, formed at Buonalbergo, with a capital of 300,000 lire; La Società Idroelettrica Val d'Argri di Missanello, of Missanello (Potenza), capital 100,000 lire; La Società Elettrica di Maccarese, Rome, capital 20,000 lire; La Società Elettrica Val Breggia, Milan, capital 55,000 lire; La Consorzio. Distribuzioni Elettriche "CDE," Genoa, capital 5,000,000 lire; and La Società Distribuzioni Elettriche Liguri, Genoa, capital 100,000 lire.

Catalogues and Lists.

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, S.W.1.—April stock list of motors and dynamos.

The B.E.N. PATENTS, LTD., 96-98, Victoria Street, S.W.1.—An illustrated and priced pamphlet dealing with a universal saw and sanding machine.

ELECTRADIX RADIOS, 218, Upper Thames Street, E.C.4.—An illustrated catalogue of radio apparatus, electric drills, heaters, &c.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Leaflet No. 81, illustrating and describing the company's h.t. supply unit for connection to d.c. mains. Priced.

THE MIDLAND ELECTRIC MANUFACTURING CO., LTD., Barford Street, Birmingham.—A leaflet announcing reduced prices of "Memette" switches.

The BENJAMIN ELECTRIC, LTD., Brantwood Works, Tottenham, N.17.—The "Benjamin Reflector" for March-April, containing illustrated articles on industrial lighting, &c. Also a folder, "The Boyce Moto-Meter Vindicated," containing a *résumé* of the proceedings in a recent patent infringement action.

MESSRS. S. G. BROWN, LTD., North Acton.—The "Brown Budget" for April, containing notes and news relating to the company's loud speakers, telephones, &c.

MESSRS. WARREN BROS. (MIDDLESBROUGH), LTD., Electric House, Grange Road West, Middlesbrough.—An illustrated pamphlet dealing with a moisture separator for steam installations.

SUPERLAMP, LTD., 92 & 94, Paul Street, E.C.2.—April net trade price list of electrical material, accessories and appliances. Illustrated.

The CONSOLIDATED PNEUMATIC TOOL CO., LTD., 170, Piccadilly, W.1.—A catalogue of "Boyer" pneumatic tools.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A coloured showcard illustrating the construction of the Marconi "D.E.P.215" valve. Priced. Also a coloured poster depicting the company's 410 series of valves, with prices, and a folder dealing with these.

Trade Announcements.

MESSRS. L. APPLE, LTD., 13, Brewer Street, W.1, and 79a, Tottenham Court Road, W.1, state that they have no connection with any firm trading under a similar name.

MESSRS. BUGLASS & JAMIESON, LTD., Dundee, state that Mr. J. F. Buglass, formerly a director and latterly a manager, has now left their employment. Mr. T. C. Donald, Stirling, has been appointed director in place of Mr. Buglass, and Mr. W. E. Jamieson has been appointed managing director.

The BRITISH B.A.G., LTD., has removed its head office and stores from Manchester to 23, Farringdon Avenue, E.C.4. The sales organisation will in future be conducted from London under the management of Mr. H. W. Dauncey.

MESSRS. R. STIRLING & Co. have recently removed from 85, Douglas Street, to 167, Holm Street, Glasgow. The telephone number is unaltered.

MR. C. P. ABRAHAM, wireless engineer, has opened new premises at 32, Castle Street, Hastings.

MESSRS. G. DIKKERS & Co. (ENGLAND), LTD., have been appointed sole agents in the British Isles for Messrs. Willem Smit & Co., Ltd., and have moved to new premises at Avenue Chambers, Southampton Row, W.C.1 (Telephone: Holborn 3100; telegrams: "Dickavalve, Westcent, London.").

The NEW ITALIAN ART ASSOCIATION, LTD., has moved to larger premises at 57-58, Wells Street, W.1. Telephone: Museum 0383.

MESSRS. WARD & GOLDSTONE, LTD., have purchased the plant, machinery, and goodwill of the Knivetown Electric Wire Co., late of Ponders End, and they are now able to supply all the specialities previously manufactured by that company.

COVENTRY ELECTRICAL ACCESSORIES, LTD., has appointed MESSRS. HARWELL, LTD., 28, John Street, Theobald's Road, W.C.1, as selling agents for its appliances.

Bankruptcy Proceedings.

O. WALKER, trading as the Albion Electric Co., Albion Street, Wallasey.—The public examination of this debtor was held at the Birkenhead Bankruptcy Court on April 6th. The liabilities were stated to be £1,056 and the assets £54. Debtor stated that he commenced business in April, 1923, with £50 borrowed from his mother. The business was successful for two years, but then negotiations for a partnership fell through, and he borrowed further sums from relatives. During the first two years the turnover was about £3,000 and the profit between £150 and £200. He admitted that the loss of £1,000 had occurred during the last year, and said that he had kept no books or accounts of receipts and pay-

ments. The Registrar censured the debtor, stating that he was not satisfied with his statements, and adjourned the examination *sine die*.

P. J. White, 5, Dyer's Buildings, Holborn, merchant, trading as P. J. White & Co.—The first meeting of creditors was held on April 7th, at the London Bankruptcy Court, when accounts were presented showing liabilities of £5,849 and assets consisting of office furniture £40, and a bad debt £821. The Official Receiver reported that the debtor had been connected with various electrical companies. He was a director of the Anglo-Colonial Engineering Co., Ltd., which was registered in March, 1914, to carry on business as electrical and general engineers, and to which he introduced various agencies. In 1915 the company went into liquidation. The debtor continued business, and in August, 1919, formed P. J. White & Co., Ltd. He attributes his failure to inability to recover £820 from the Radio Equipment Co., Ltd., which went into liquidation in 1926; also to general trade depression. The case was left in the hands of the Official Receiver.

J. D. Chisholm, 34, Gordon Square, W.C.—This debtor came before Mr. Registrar Warmington at the London Bankruptcy Court on April 13th for his adjourned public examination. He formerly carried on an agency at Leeds for a London firm of electrical engineers, and in October, 1924, formed a company to which he transferred his various radio and electrical inventions. A receiving order was made against him in October, 1925, when he returned liabilities of £976, against assets valued at £4,154. Mr. Waterer, Official Receiver, reported that the debtor recently obtained an order to rescind the receiving order on the ground that all the debts had been paid in full. It transpired later that certain debts had not been included, whereupon the rescinding order was cancelled and the debtor was directed to amend the statement of his affairs and attend at the Court for further public examination. The debtor was not in attendance, and his examination was adjourned *sine die*.

A. H. Hughes, Eckington Road, Coal Aston, Derbyshire, wireless and electrical merchant.—The public examination of this debtor was held on April 8th, at the County Court, Chesterfield. According to the statement of affairs there was a deficiency of £2,836. Debtor said that he had suffered losses through ill-health, and he attributed his failure to lack of capital and loss of commission on over £30,000 worth of orders which had to be cancelled on account of his health. The examination was adjourned.

V. Reed, electrical engineer, 10, Chapel Road, Eastville, Bristol.—Trustee, Mr. F. W. Darley, Official Receiver, 26, Baldwin Street, Bristol, released April 4th.

J. Benson, electrical engineer, late of 2a, Wade Street, Leeds.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds, released April 1st.

E. Cowley (trading in co-partnership with G. Hill and G. Noble as G. Hill & Co.), electrical engineer, 22, Chantry Lane, Great Grimsby. Discharge suspended for 12 months.

A. T. K. Moir (Moir & Watts), electrical and mechanical engineer, Weardale Road, Lee, Kent.—Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C., released March 24th.

J. R. Barker, wireless dealer, Tanshelf House, Front Street, Pontefract, and 183, Kirkgate, Wakefield.—Trustee, Mr. B. S. Briggs, Official Receiver, 21, King Street, Wakefield, released April 5th.

Company Liquidations.

Kingsway Radio, Ltd., radio and electrical dealers, 92, Cannon Street, E.C.4.—A meeting of creditors was held on April 12th, at the Institute of Chartered Accountants, E.C. The chair was occupied by Mr. W. Cranstoun Todd, C.A., 3, Cannon Street, E.C., the liquidator in the voluntary liquidation of the company. The statement of affairs presented showed ranking liabilities of £1,044, and the assets were estimated to realise £428 net, leaving a deficiency so far as the creditors were concerned of £616. As regarded the shareholders, there was a deficiency of £2,894. The business was originally carried on by Mr. H. L. Percy, and the company was registered on October 2nd, 1925, the nominal capital being £3,000, in £1 shares. The shareholders were: Mr. Percy, 400 shares, Mr. W. J. Mather, 650 shares, Mr. Butler, 500 shares, and Miss Sutherland, 300 shares. The purchase price for the business was £1,007, which was discharged by the allotment to the vendor of 1,000 shares and the payment of the balance in cash. The remaining shares were issued for cash. A balance sheet prepared at the end of the first year's trading showed sales of £2,840, with a net loss of £570. There had been a slump in the wireless business, and the trading of the company had been considerably affected. If the stock was forcibly realised at auction there would probably be very little for the creditors. The liquidator was therefore continuing the business for the time being in order to dispose of the stock at reduced prices. It was not possible to sell the business as a going concern. The business could not stand the heavy expenses with which it had been faced. Mr. Percy had lectured on wireless in the City, and it had been hoped that the connection of the company would be largely increased. A resolution was passed confirming the voluntary liquidation of the company with Mr. Todd as liquidator. The following are creditors:—

	£		£
Dickinson, C. B., Ltd....	182	Ever Ready Co., Ltd. ...	38
Burndept Wireless, Ltd.	42	Edison Swan Electric Co., Ltd.	22
General Electric Co., Ltd.	44	Ericsson Telephones, Ltd.	45
S.T., Ltd.	33	Browning, H. S. ...	37
Pathé of France, Ltd. ...	34		

Foolproof Patent Accumulator Co., Ltd.—The joint liquidators in the voluntary liquidation have issued a statement as at March 25th, the date of the winding-up resolution, showing ranking liabilities of £3,044 and assets estimated to produce £1,028, leaving a deficiency of £2,016. The issued capital is £1,000, making the deficiency, so far as the shareholders are concerned, £3,016. A trading account shows a net loss of £1,942, and the balance of the deficiency is attributed to the writing down of machinery, plant, &c. A meeting of creditors was held at Market Harborough on April 11th. The statement of affairs and trading account were explained by Mr. John S. Bullivant for the liquidators. Mr. Bullivant said that the company was incorporated in October, 1925, to carry on a business commenced by Mr. Judd in Market Harborough. Mr. Millington, Senr., provided the capital of £1,000, shares being allotted: 900 to Mr. Millington, Senr., 50 to Mr. Millington, Junr., and 50 to Mr. Judd, the Messrs. Millington leaving the conduct of the business practically entirely in the hands of Mr. Judd. Nothing at all was done in the way of production or experimental work until February, 1926; from that date until August, two hands were employed in addition to Mr. Judd. No sales appeared in the books until August. From August until the date of winding up of the company, the personnel was increased and the average weekly wage paid was between £30 and £40; the whole of the output of the factory was manufactured during that period. The records of the transactions were very incomplete. Mr. Millington, Senr., had advanced £591 for payment of the company's debts. The deficiency was attributed to wages, materials, and sundries expended in experimental work, &c., useless advertising, difference between cost price and estimated realisation price of plant and stock, non-productive expenses, patents, &c., and trading loss. The liquidators were in touch with five applicants to purchase part or whole of the assets, and it was hoped to find a purchaser who would take over the whole of the assets.

Radi-Arc Electrical Co., Ltd.—Winding up voluntarily. Liquidator, Mr. E. James, St. Lawrence House, Trump Street, E.C. Meeting of creditors, April 27th, at the Institute of Chartered Accountants, Moorgate Place, E.C.

Private Arrangements.

P. M. Braidwood, Somerset Road, New Barnet, and 1, High Street, Barnet, electrical contractor.—A meeting of creditors was held on April 12th, at the offices of Messrs. Goodman, Sons & Co., Broad Street House, E.C., when a statement of affairs was presented which disclosed liabilities of £1,885 and net assets of £355, leaving a deficiency of £1,530. A deficiency account was presented which showed that during the seven years to April, 1927, the drawings had totalled £1,068, whilst there had been an estimated loss on the trading during the period of £337, and for the purposes of the statement the assets had been depreciated by £125. The debtor consulted his accountant during the previous week owing to two writs having been served upon him. The largest creditors suggested that a meeting should be called. The debtor started trading in 1921 with a capital of only £10, and he carried out a number of small contract jobs. He then realised investments amounting to about £200, the money going into the business, and from that time onwards the business increased, and he took on larger contracts. He was also assisted financially by his mother and sister, who were cash creditors. In reply to questions, the debtor stated that he had a contract in connection with a school on which a substantial balance was due, the work having been completed six months ago. He also had a contract in connection with the East Barnet Housing Scheme, where fifty dwellings were being erected. He had been doing a fairly substantial turnover, which during the last nine months had totalled £2,139. He did not think that the business could be continued profitably by him, but relatives were willing to assist him to pay a composition of 5s. in the £, by two equal guaranteed instalments at three and six months. A resolution was passed accepting the offer, and it was decided that Mr. W. A. J. Osborne, of Messrs. Corfield & Cripwell, Balfour House, Finsbury Pavement, E.C., should act as trustee, together with a committee consisting of Mr. C. Latham, and the representatives of Messrs. Poppleton, Appleby & Hawkins, and Falk, Stadelmann & Co., Ltd. The following are creditors:—

	£		£
W. T. Henley's Telegraph Works Co., Ltd.	230	Weinbaum Incandescent and Electric Co. ...	40
Falk, Stadelmann & Co., Ltd.	138	Brown Bros.	23
Young & Wildsmith, Ltd.	87	General Electric Co., Ltd.	29
Charlesworth, Peebles, Ltd.	67	Smith, J. & W. B., Ltd.	28
Macintosh Cable Co., Ltd.	47	Jeary Electric Co. ...	23
		Supra Electric Co. ...	21
		British Thomson Houston Co., Ltd.	57

Dissolutions of Partnership.

J. R. DUNKLEY & Co., electrical engineers, 17, Station Street, Huddersfield.—Messrs. K. Levell and J. R. Dunkley have dissolved partnership. Mr. Dunkley will attend to debts and continue the business under the same style.

S. AND S. RADIO & ELECTRICAL CO., & EXIDE BATTERY SERVICE STATION, radio and electrical experts, 149, Ewell Road, Surbiton.—Mr. S. C. Slaughtern and Mr. N. P. Sparks have dissolved partnership. Mr. Slaughtern will attend to debts.

E. J. STIELL & Co., electrical engineers, Coatbridge.—The partnership existing between Messrs. E. J. Stiell, D. M. Miller, and W. C. Cullen, has been dissolved by the death of the first-named, and the retirement of Mr. Miller. Mr. Cullen will continue the business under the same style and attend to debts.

Book Notices.

In view of the importance of the paper read by Major E. I. David last year on electricity in mining, the South Wales Branch of the Association of Mining Electrical Engineers has decided to publish it in book form at a price of 1s. 6d. to members, and 3s. to non-members. Copies can be obtained from Mr. H. J. Norton, 11, Windsor Place, Cardiff, at these prices, plus 3d. postage.

"Technology Reports of the Tôhoku Imperial University, Sendai, Japan." Vol. VI, No. 3, "On the Design of an Inductance Coil for Audio Frequencies, having Iron Core with Air Gap." Maruzen Co., Ltd., Tokyo and Sendai.

The Marconi Gramophone Reproducer.

Hitherto the Marconiphone Co., Ltd., has only supplied its gramophone reproducer in conjunction with a special two-stage amplifier. Owing to the demand, however, it has been decided to make the two instruments available separately.

A "Rawlplug" Handbook.

The RAWLPLUG CO., LTD., has produced a very useful handbook dealing in detail with the various uses of "Rawlplugs." The methods of boring various materials, such as brick, plaster, tiles, &c., are set out, and the book contains numerous illustrations of typical and special "Rawlplug" jobs.

For Sale.

Yorkshire (West Riding) Electric Tramways Co., Ltd., invites offers, two 320-h.p. four-cylinder Diesel engines, two 200-kW Dick, Kerr generators, switchboard, &c., one reversible booster, and one 10-ton overhead travelling crane. By order of the Liquidator of the New Trafalgar Collieries, Cinderford, Glos., Sir I. Thomas will sell by auction at the Collieries, on April 26th and 27th, the plant and machinery, including electric generators, transformers, motor convertor switchboards, &c. Halifax Tramways and Electricity Committee invites offers for two Weir steam turbo-driven boiler-feed pumps. (See our advertisement pages to-day.)

Chinese Notes.

A considerable business in electrical irrigation is done by the Cheng Hwa Electric Power Supply Co. in the Kiangsu province. The company has a 6,400-kW generating plant and hires out complete pumping plants, including the necessary pole lines, to the farmers. Originally the charge was based upon the area of the fields operated upon, but later the company substituted an electricity consumption basis with a minimum per *mow* (⅙ of an acre) of 10 kWh.

The Pu Hwa Hsing Chi Electric Co. (Wenchav, Chekiang province) now supplies electricity to about 20,000 16-c.p. lamps. It recently reorganised and raised its capital from $100,000 to $150,000. The promoters also run a telephone service (the Tung Wu Telephone Co.), which has over 200 subscribers.

Great Britain's Radio Exports.

The *Wireless Trader* of April 9th published details of our radio export trade during February. The total (excluding re-exports) was £119,767 (valves £23,006), as compared with £88,765 in January (valves £11,532). Japan was again the chief customer, taking goods to the value of £51,904 (as against £14,684); Australia retained second place with £13,132 (against £12,980); but the Netherlands succeeded Russia in the third place with a total of £6,830.

Our Foreign Electrical Trade.

The following were the values of imports and exports of electrical goods and machinery during March:—

	March, 1927.	Inc. or dec.
Imports.—	£	£
Electrical goods and apparatus ...	327,988	+40,033
Machinery	1,344,470	+65,865
(Electrical machinery)	138,728	+21,573
Exports.—		
Electrical goods and apparatus ...	959,787	−35,067
Machinery	4,134,580	−11,763
(Electrical machinery)	577,604	+93,191
Re-exports.—		
Electrical goods and apparatus ...	13,494	− 7,066
Machinery	149,492	+22,089
(Electrical machinery)	8,785	− 2,978

Robust Automobile Lamps.

Another example of the survival of an automobile lamp from the effects of a collision is reported by the General Electric Co., Ltd. Although the headlight in which it was fitted was badly hit, the "Osram" lamp still shone out when switched on.

Unemployment.

The reduction in the number of unemployed, which received a check in the previous week, continued during the week ended April 4th, a fall of 7,930 being registered. The actual total was 1,073,800, as compared with 1,081,730 on March 28th and 1,049,790 on April 5th, 1926.

Registered Contractors.

At its meeting on April 8th the Executive Committee of the National Register of Electrical Installation Contractors accepted the following applications for registration. At the same meeting one application was withdrawn and four were declined:—

Anderson & Penny, Ltd., South Shields.
Gee & Brown, Sunderland.
Bulsen, W., & Co., Newcastle-on-Tyne.
South Shields Plumbing Co., Ltd.
Mohan, T. G., Sunderland.
Webber & Hudgell, Hastings.
Foreshaw & Bradshaw, Belfast.
Clark, O., South Shields.
Foote, Milne & Co., London, S.W.9.
Taylor, T. A., Chester-le-Street.
Wight, B., & Co., London, N.10.
Worksop Co-operative Society, Ltd.
Clarke, W. T., & Co., Ltd., London, W.C.1.
Rosson, A. C., Croydon.
Ormerod, W., Todmorden.
Gordemer, A., London, E.5.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, &c.	Price April 19th.	Fortnight's inc. or dec.
a Acid, Oxalic ... ... per lb.	5½d.	...
a Ammoniac, Sal ... ... per ton.	£60	...
a Ammonia, Muriate (large crystal) ,,	£52	...
a Bisulphide of Carbon ... ... ,,	...	...
a Borax ... ... ,,	£26	...
a Copper Sulphate ... ... ,,	£35 10s.	...
a Potash, Chlorate ... ... per lb.	4d. to 4½d.	...
a ,, Perchlorate ... ... ,,	5½d.	...
a Shellac ... ... per cwt.	£13 10s.	...
a Sulphur, Commercial ... ... ,,	£9 10s.	...
a ,, Roll ... ... ,,	£9 10s.	...
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	...
a ,, Crystals ... ... per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks ... per lb.	4d.	...
METALS, &c.		
b Aluminium, Ingots... ... ... per ton.	£107 to £112	...
b ,, Wire ... ... per lb.	1/6 to 2/-	...
b ,, Sheet ... ... ,,	1/8 to 2/9	...
p Babbitt's Metal and Anti-friction Metal—		
Grade I ... ... per ton net.	£272	...
Grade II ... ... ,, ,,	£189	...
Grade III... ... ... ,, ,,	£97	...
Brass (rolled metal 2' to 12' basis) per lb.	9¾d.	...
c ,, Tubes (solid drawn) ... ,,	11¾d. to 11¾d.	...
c ,, Wire, basis ... ... ,,	9¾d.	...
c Copper Tubes (solid drawn) ... ,,	1/0½	...
c ,, Bars (best selected) ... per ton.	£86	...
c ,, Sheet ... ... ,,	£96	...
c ,, Rod ... ... ,,	£86	...
d ,, (Electrolytic) Bars ... ,,	£63	...
d ,, ,, Sheets ... ,,	£143 10s.	...
d ,, ,, Wire Rods ... ,,	£73	...
d ,, ,, H.C. Wire per lb.	9½d.	...
f Ebonite Rod ... ... ,,	2/8 to 2/8	...
f ,, Sheet ... ... ,,	2/8 to 2/6	...
g German Silver Wire ... ... ,,	2/3	...
h Gutta-percha, fine ... ... ,,	6/-	...
h India-rubber, Para fine ... ... ,,	1/5½	...
i Iron Pig (Cleveland No. 3.) ... per ton.	122/6	...
i ,, Wire, galv. No. 8, P.O. qual. ,,	£21	...
g Lead, English pig ... ... ,,	£26 5s.	...
g Mercury ... ... per bot.	£22 15s. to £23	20/- to 30/- a b.
e Mica (in original cases) small ... per lb.	3d. to 3/-	...
e ,, ,, medium ... ,,	4/- to 8/-	...
e ,, ,, large ... ... ,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings ,,	1/3½	...
p ,, ,, drawn bars & rods ,,	1/3	...
p ,, ,, rolled strip & sheet ,,	1/2½	...
p ,, ,, wire... ... ... ,,	1/0½	...
e Platinum ... ... per oz.	£29	...
d Silicium Bronze Wire ... ... per lb.	10¾d.	...
r Steel, Magnet, in bars ... ... ,,	7½d.	...
a Tin, Block (English) ... ... per ton.	£303 to £304	£5 dec.
a ,, Wire, Nos. 1 to 18 ... ... per lb.	4/9	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boer & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
j Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Lighting and Power Notes.

Aberdeen.—New Sub-Station.—A new sub-station at the Corporation electricity works, which has cost £35,000, was formally inaugurated by Lord Provost Lewis on April 9th.

Accrington.—Hire-Purchase Scheme.—It was announced at the April meeting of the Town Council that it is proposed to sell electrical appliances on the hire-purchase system, goods to be paid for on the basis of 1s. per quarter for every £1 in value.

Ashford (Kent).—Loans.—The Urban District Council has applied for sanction to the following loans:—£5,000 for mains and services; £500 for meters; £900 to cover excess expenditure on generating plant; £500 for domestic apparatus to be let out on hire; and £500 for assisted wiring installations. Street lamps in three portions of the town are to be converted from gas to electricity.

Australia.—Victoria.—The *Industrial Australian and Mining Standard* reports that satisfactory progress is being made with the construction of the Rubicon (Vic.) hydro-electric scheme, and the main channel work is now nearing completion. The construction of the diversion weirs on the Royston and Rubicon rivers is well in hand and work on the transmitting sub-station is progressing well, all the foundational construction being completed. The system is to be in operation by 1928, but at the present rate of working the lower power stations will be in operation much earlier.

Canada.—Manitoba.—A recent Government survey of the water-power resources of Manitoba has revealed the existence of over 3,000,000 continuous h.p. which is available for development. At the present time a total of 225,800 h.p. of turbine plant is in use, with provision to increase this to an ultimate capacity of 310,000 h.p.

Chatburn.—Protest Against Charges.—At a recent ratepayers' meeting protests were made against the charge of 2d. per kWh, over and above the amount charged by Clitheroe, to consumers in the borough. A resolution was adopted refusing to take supplies except at the Clitheroe rate of 6d. per kWh for lighting and 1½d. per kWh for power.

Continental.—Italy.—A regulation has recently been issued by the Italian Government which provides that the importation from, or exportation to, adjacent foreign countries of electricity can only be undertaken by special Government permit, which in approved cases will be granted for periods of ten years. A tax of 25 centimos per kWh is to be imposed on all imported energy.

Dover.—Electricity Supply.—It was reported at a recent meeting of the Electricity Committee that the cost of changing the periodicity of the electricity supply would amount to £20,153. It was decided to engage a consulting engineer to report on the whole of the electricity undertaking, including the question whether or not there should be a change of periodicity.

Dumfries.—Loan.—The Town Council has applied for sanction to a loan of £4,000 for a new storage battery and battery booster.

Hastings.—New Transformer.—The Electricity Committee has recommended the provision of an additional transformer at Bromsgrove power station, at a cost of £2,345.

India.—Hydro-Electric Development.—According to *Indian Engineering*, it is stated that the South Indian Railway Co. has agreed, subject to certain conditions, to purchase 50 per cent. of the power available from the Pykara hydro-electric scheme. A committee appointed to consider the possibilities of the scheme has reported that the Government can continue the work with confidence.

Formby.—Electricity Charges.—The Urban District Council has reduced the price of electricity for power purposes from 3½d. to 3d. per kWh up to 500 kWh, and introduced a new scale of 2½d. per kWh from 500 to 1,000 kWh, and 2d. per kWh over 1,000 kWh per annum. The scale of charges for lighting purposes remains unchanged.

Leeds.—New Power Station.—The Electricity Commissioners have sanctioned the erection of a new generating station at Kirkstall by the Corporation.

London.—Hammersmith.—The Electricity Committee has received a report from the borough electrical engineer upon the question of augmenting the existing e.h.p. ring main in order to meet the increasing demand of consumers supplied from the Starch Green sub-station, including the Chiswick Electric Supply Corporation, Ltd., and has recommended the laying of a duplicate .075 sq. in. six-core cable from the power station to Rivercourt Road sub-station, at an estimated cost, including the provision of switchgear at the power station, of £4,659.

St. Pancras.—The Borough Council has received a reply from the Electricity Commissioners regarding its proposal to install additional plant at King's Road station. The Commissioners state that the policy of inter-connection is preferable to the installation of additional plant, and suggest as an alternative that inter-connection between (1) St. Pancras, Islington and Hackney; (2) St. Pancras, St. Marylebone, and the London Power Company's station at Grove Road; and (3) St. Pancras and the City Road station of the County of London Electric Supply Company, should be explored to meet the Council's requirements.

Opposition to Scheme.—The London Power Co., Ltd., has notified the L.C.C. that it has applied for sanction to erect a power station between the south bank of the River Thames and the Great Western Railway goods depôt in Battersea Park Road. As the L.C.C. has property near the site, the Parliamentary Committee of the L.C.C. has recommended that the proposal be opposed, if necessary, with a view to obtaining protection for the Council's interests.

Macclesfield.—Electricity Supply.—The Town Council has decided to engage an expert, at a fee of £700, to prepare a report with regard to the local electricity supply and its possible development in the future. This is with a view to the probable purchase of the local electricity undertaking.

Maybole.—Street Lighting.—The rival claims of electricity and gas for street lighting were discussed at the last meeting of the Town Council. A report by Mr. Campbell Murray, M.I.E.E., letters from Mr R. B. Mitchell, manager, Glasgow Corporation Electricity Department, and Mr. Bexon, manager of the Ayrshire Electricity Board, were read. The last stated that he would recommend his Board to provide steel poles throughout the burgh, free of any extra cost, provided the Council agreed to take electricity for street lamps. The cost of furnishing the street lights would be approximately £12 per lamp. The Gas Company quoted an all-in price of 35s. per lamp per annum for a ten-years' contract. It was agreed to accept the Electricity Board's offer.

New Zealand.—Arapuni Hydro-Electic Scheme.—The Auckland correspondent of the *Daily Telegraph* reports that it is announced officially that the Arapuni hydro-electric scheme to supply the whole of Auckland province with electricity will not be completed until the end of 1928 owing to delays caused by floods. Messrs. Armstrong Whitworth's contract date for the completion of the work is April, 1928.

Portland.—Electricity Supply.—At a recent meeting of a Special Committee of the Urban District Council the report from Messrs. A. Hugh Seabrooke & Partners on a scheme for the supply of electricity at an estimated initial cost of from £9,000 to £10,000 was considered, and approved.

Pontypridd.—Inauguration of Extensions.—The Earl of Plymouth has consented to formally inaugurate, on April 26th, extensions which have recently been carried out at the power station of the South Wales Electrical Power Distribution Co.

Preston.—Electricity Supply.—At a recent meeting of the local Trades Council it was stated that after the fourth generating set had been installed, the Corporation intended to introduce a block system for the distribution of electricity. Instead of having a meter for each house, one meter would serve for a whole street, and in time electricity would be paid for as consumers now paid for water.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Stoke Newington.—Lighting: Scale B, from 5d. to 4½d. per kWh. Power: Maximum demand system, from 4½d. and 1d. per kWh to 4d. and 1d.; scale E, from 2d. per kWh for the first 5,000 kWh per annum and 1½d. per kWh beyond, to 2d. per kWh for the first 5,000 kWh, 1½d. for the next 5,000, and 1d. per kWh for all further consumption. Domestic scale: From 1½d. to 1d. per kWh. Public lighting: The increase added in September last to be removed.

Hendon.—*The Hendon Electric Supply Co., Ltd.*—The surcharge of ¼d. per kWh, due to the coal dispute, has been withdrawn.

Scunthorpe.—Lighting: From 7d. to 6d. per kWh. Power: From 3½d. to 2½d. per kWh.

Ripon.—Electricity Supply.—The City Council has accepted terms offered by the Harrogate Corporation Electricity Department to supply electricity to the city. The scheme is subject to confirmation by the Harrogate Town Council, and follows the recent purchase by the latter authority of the Knaresborough electricity undertaking. Harrogate hopes to extend its supply to a wide area in which the chief centres of population are the three towns mentioned.

Rothesay.—Inauguration of Supply.—A new power station was formally inaugurated by Mrs. Fisher, wife of ex-Provost Fisher, on April 12th.

South Africa.—Cape Town.—A special meeting of the City Council was held recently for the purpose of adopting a proposal to borrow £500,000 for electrical development. The programme includes (a) land and buildings, £30,000; (b) machinery, £87,750; (c) distribution, £382,250. A meeting of enrolled owners was subsequently held and the proposals were unanimously agreed to.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by the Urban District Council of Portland, authorising it to supply electricity in its area, and the Woodstock Power Syndicate, Ltd., to supply electricity in the borough of Woodstock and certain parishes in the rural district of Woodstock.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them for the supply of electricity by Blackpool Corporation in the urban district of Poulton-le-Fylde, and certain townships in the rural district of Fylde, and the West Lancashire Rural District Council in the parishes of Maghull and Lydiate.

Stockport.—ELECTRICAL DEVELOPMENT.—The Electricity Committee has recommended that application be made for sanction to a loan of £260,000, being the estimated cost of the first section of a scheme for the further development of the Millgate electricity works. This includes the installation of one 25,000-kW turbo-alternator at a cost of £65,000, four 50,000-lb. boilers (£67,000), and buildings (£60,000). According to the *Cheshire Daily Echo*, the borough electrical engineer (Mr. R. Lomax), in his report, states that the Millgate site can be developed to a capacity of from 130,000 to 140,000 kW. The extension proposed at present would increase the capacity of the station to 57,000 kW. The cost of the full development of the site is estimated at £900,000, the cost of the plant being under £10 per kW.

Torquay.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £5,383 for the extension of the Upton Valley sub-station and the erection of stores adjoining the destructor.

United States.—ELECTRICAL DEVELOPMENT.—According to the *Electrical World*, power companies in Texas are to carry out extensions of transmission lines during this year aggregating more than 500 miles, which will add 75 communities to the list of towns supplied with electricity. The Texas Power and Light Co. is negotiating for the purchase of the dam across the Colorado River at Austin, and proposes to spend $1,000,000 in rehabilitating the dam and hydro-electric plant. During 1926 the company put into operation the new Trinidad power station with an initial capacity of 50,000 kW. This station is designed for an ultimate capacity of 160,000 kW. The Dallas Power and Light Co. is installing an additional 25,000-kW set, and is to carry out extensive additions to its transmission line network. The power companies of Texas have a total of 4,500 miles of h.p. transmission lines, serving more than 350 towns and cities in an area covering the greater portion of the State. There are 33 generating stations connected to this system, which have a combined capacity of approximately 320,000 h.p.

Walsall.—EXTENSION OF SUPPLY.—The Town Council has under consideration a proposal to extend the e.h.p. feeder to the Scott Arms and to erect a sub-station for the supply of electricity to Great Barr.

Yarmouth.—LOAN SANCTIONED.—The Corporation has received sanction to a loan of £50,229 for mains, buildings, plant, and works consequent upon the change of system, in addition to a loan of £120,000, previously sanctioned. The Electricity Commissioners have intimated that they will consider further loans, if necessary, when the final cost has been ascertained.

Tramway and Railway Notes.

Blackburn.—TRAMWAY EXTENSION.—The Town Council has referred to the General Purposes Committee the question of extending the existing tramway and the seeking of powers to run motor-'buses.

Canary Islands.—TENERIFFE.—The tramway undertaking in Teneriffe, owned by a Belgian company, has been sold to a Canary Islands syndicate for 500,000 pesetas.

Continental.—ITALY.—A convention has been signed between Italy and the Republic of San Marino for the construction of an electric railway between Rimini and San Marino.—*Reuter's Trade Service* (Rome).

CZECHO-SLOVAKIA.—The Austrian Schuckert Co., of Vienna, is negotiating for the construction of a narrow-gauge electric railway in North Bohemia, between Warnsdorf and Rumburg, on the Saxon frontier.

Gravesend.—ABANDONMENT OF TRAMWAY.—The Ministry of Transport has notified the Corporation that an Order will be issued for the abolition of the Gravesend and Northfleet tramways.

Irish Free State.—DUBLIN-LUCAN ELECTRIC TRAMWAY.—The Dublin United (Electric) Tramway Co.'s Bill for taking over the Dublin-Lucan electric tramway and linking up the line with the city service at Parkgate Street has now passed both Houses of the Free State Legislature and will become law immediately. Work will begin shortly on the repair of the line and on the necessary alterations at the Dublin end.

Nottingham.—RAILLESS CARS.—An innovation with regard to municipal transport arrangements has just been introduced by the utilisation of railless cars upon the Sherwood Rise route. Ten of these cars have been placed in commission and are proving satisfactory.

Sheffield.—INAUGURATION OF ROUTE.—The new Abbey Lane section of the Corporation tramways was formally inaugurated by the chairman of the Tramways Committee, on April 14th. This section completes the circular City-Millhouses-Woodseats-City route; the cars run on one side of the road and vehicular traffic on the other. Where it is necessary to cross over, various safety devices have been adopted, including electric signals, which can be illuminated at night to warn other traffic that a car is about to cross.

United States.—RAILWAY ELECTRIFICATION.—Work on the construction of the tunnel in the Cascade Mountains, Washington, which will cost $10,000,000, is making good progress, and indications are that it will be completed before the end of next year. With its completion approximately 100 miles of the Great Northern railway will be electrified. The *Electrical World* reports that the Washington Water Power Co. has taken over and is developing the Chelan River power project with a view to the eventual electrification of the Great Northern railway east of Wenatchee and through Northern Idaho. Full development of this power, it is estimated, will cost $10,000,000. The arrangement with the Washington Water Power Co., while safeguarding future needs of the Great Northern railway for electrification purposes, provides for making power available for public use, and making possible the irrigation of several thousand acres of land now idle. The Chelan power project is unrelated to the electrification of the line between Wenatchee and Everett. Power for that part of the line will be supplied from hydro-electric plants on the west side of the Cascade Mountains. In connection with this electrification, the Great Northern already has in service two new electric locomotives of the motor-generator type built by the Baldwin Locomotive Works and the Westinghouse Electric and Manufacturing Co. They are the most powerful of their kind, each of them weighing 715,000 lb. and having a tractive force of 88,500 lb.

Telegraph and Telephone Notes.

Continental Telephony.—LONG-DISTANCE COMMUNICATION.—As the result of successful trials, direct telephone communication between Prague, Stuttgart, and Paris has been established, and a regular service has been opened. Tests are now being carried out between Paris and Budapest, the underground cable between Paris and Vienna being utilised, and then the overhead wire between Vienna and Budapest; so far the tests have been considered quite satisfactory.—*Reuter* (Paris).

Telephone communication by the new cables recently installed between Brussels and Antwerp and London has been satisfactorily tested, and the new lines will be opened for public use at the end of the month.

India.—"BEAM" RADIO-TELEGRAPHY.—It was recently announced in the Council of State at Delhi that official "beam" radio-telegraph transmission tests from the Poona station would commence in May and that the service would actually commence in June. The Indian system consists of a transmitting station situated about six miles from Poona. The site is at an elevation of about 2,200 ft. above sea level, and the area at present utilised for the buildings and aerial system does not exceed 20 acres, but considerable space has been allowed for any extensions which may be made in the future. Heavy fuel oil is used for power production. The receiving station is situated about four miles from the small town of Dhond and about 50 miles from the Poona station, and lies in open, wide country, so that there is no screening to interfere with the reception of signals. These stations will link with the Grimsby transmitter and Skegness receiver in England (the latter are described elsewhere in this issue).

BOMBAY TELEPHONES.—The Bombay Telephone Co. has earned a good profit for the year 1926 in spite of trade depression. It is proposed to introduce the message-rate system, experience of this at Calcutta having shown that in the case of business, as well as residential, areas over 65 per cent. of the users are paying less under that system of charging than they would have paid under flat rates. The slight opposition to the introduction of the message-rate system in Bombay will therefore soon be overcome.

San Marino.—NEW RADIO STATION.—A convention has been signed by representatives of Italy and the Republic of San Marino for the construction of a wireless station at San Marino.—*Reuter's Trade Service* (Rome).

Santo Domingo.—NEW RADIO-TELEGRAPH PLANT.—The Minister of Promotion and Communications has ordered new equipment for the radio station at Santo Domingo, South America (the international call letters assigned to the Republic being HIA-HIZ), to provide direct communication with New York, 1,225 miles distant, and other stations within a radius of 1,500 miles. The old equipment will be utilised at a radio station to be erected at Puerto Plata, the principal seaport on

the north coast of the island, and it is also proposed to install a low-power station at Sanchez, on the Bay of Samaná.—*Reuter's Trade Service* (Santo Domingo).

Transatlantic Cables.—Storm Damage.—The "beam" radio-telegraph service assisted in coping with traffic congestion last week, which was caused by the interruption of operation of one of the Imperial cables across the Atlantic Ocean, which the *Evening News* explains was "cut" in bad weather off the Newfoundland coast. At the same time the aurora borealis interfered with all traffic *via* Newfoundland and Nova Scotia.

United States.—Telephone Service Growth.—Remarkable figures indicative of the growth of telephone service in America during recent years are contained in the annual report of the American Telephone and Telegraph Co. for 1926. On December 31st, 1910, there were 5,882,719 telephones in the country, by means of which 22,284,010 calls were made every day; in December, 1926, there were 17,574,252 telephones (almost a threefold increase), and 52,354,834 calls were made daily. The total value of the plant has increased from 611,000,000 dollars (about £122,200,000) in 1910 to 2,783,000,000 dollars (about £556,600,000) in 1926; more than 255,000,000 dollars (£51,600,000) was spent on plant during 1926. It is notable that, as the sphere of a telephone system widens, the cost per telephone rises: the cost per telephone in America, which was 157.16 dollars in 1910, had risen in 1926 to 218.27 dollars. In 1900, when there were some 10,000 stockholders, the revenue of the company was 45,000,000 dollars (£9,000,000); in 1926 the revenue was 844,000,000 dollars (£168,800,000) and the number of stockholders 400,000, the largest number recorded in any one business venture.

Radio Notes.

Bulgaria.—Reception Ban Removed.—Bulgarian citizens have hitherto not been allowed to use wireless, the only sets permitted in the country being those belonging to Government administrative bodies, the Ministry of War, and Bulgarian merchant vessels. The Government has now, however, decided to permit their use by the general public, although transmission will remain a State monopoly. Owners of receiving sets will be required to pay a fixed subscription and to undertake to conform to such regulations as may be made.—*Reuter* (Sofia).

Colombia.—Improved Service.—In his message to Congress, the President of Colombia, South America, announced the immediate provision of an improved broadcasting service. Twelve sets are to be used, all of high power (the international call letters assigned being HJA-HKZ). The message has attracted much favourable attention, as hitherto there has been no broadcasting in Colombia, where static is bad during most of the year in the greater part of this extremely mountainous country. The best reception is obtained from January to March. The recently-opened stations at Caracas (Venezuela) and Balbóa (Panamá) are expected to benefit broadcasting in Colombia.—*Reuter's Trade Service* (Bogota).

New Continental Stations.—Italy.—The publication is expected of a decree-law instituting a new company to take over the wireless telephony services, and appointing a supervisory committee. The decree will fix the composition of the board of the company and the staff of artists, which is to be predominantly Italian, and require the execution of the following technical plan: the replacement of the present station at Milan by another of 7 kW; the erection at Genoa of a 11.5-kW station; at Rome, one of 25 kW; at Florence, Turin, Naples, and Bari stations of 3 kW, and at Palermo one of 7 kW.—*Reuter's Trade Service* (Milan).

The new transmitter at Milan, which will deliver 7 kW to the aerial, is nearing completion.

The Italian Government Commission examining broadcasting finance has adopted a resolution recommending the Government to impose a small tax. All Italians are instinctively against the suggestion of a licence tax, says the *Financial Times*.

Sweden.—The new Motala station, which has been testing for some time, was to begin regular operation before Easter.

Finland.—A station is to be built in Lahtis at a cost of about $200,000, which is part of a loan granted the country by an American concern. At present there are only two radio stations in Helsingfors and one in each of the following towns:—Tammerfors, Bjorneborg, Lahtis, Jyvaskyla, and Jakobstad. The stations in Helsingfors belong to the Army and those in the other towns are privately owned. None of them is equipped for modern broadcasting, says *Commerce Reports*, and it is expected that the new station will stimulate interest and increase the sale of equipment.

India.—Listeners Increase.—According to the annual report of the committee of the Bombay Radio Club for the year 1926, the number of members increased during the year to 585. The Club had broadcast upwards of 300 concerts, and the programmes were received in places many hundreds of miles distant. It is intended by the Technical Committee to install in the current year small transmitters, of both long and short waves, for communication with other amateur stations in India and to start a class in Morse receiving and dispatching, if sufficient members accord their support. It is expected that the Indian Broadcasting Co. will commence its regular broadcasting services from Bombay and Calcutta in August next. Mr. Page, director of the Bombay station, and Mr. Wallace, director of the Calcutta station, have both arrived in India. The transmitting station of the company will be 120 times as powerful as the present Bombay station (2FV).

New Zealand.—New Station.—Wellington is shortly to possess a 5-kW station. In both Auckland and Christchurch there are good stations, says *World Radio*, but so far Wellington and Dunedin have each had only a very small station. The number of licensed listeners in New Zealand is at present 13,000.

Poland.—New Station.—The Polish Broadcasting Co. (Poleskie Radio) has just placed a contract for a 10-kW station to be erected at Katowice. The equipment will be manufactured in London at the works of Standard Telephones and Cables, Limited. This order follows on the recent successes of this company in obtaining contracts in face of foreign competition for broadcasting equipments for the Irish Free State, Denmark, Japan, and New Zealand.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 10th. Postmaster-General's Department. Telephone relays. (B.X. 3333.)*
May 17th. Resistances and reactances. (B.X. 3307.)*
May 23rd. State Electricity Commission. Switchgear and accessories. (B.X. 3285.)*
May 9th. 6,600-V transformers and spares. (B.X. 3331.)*
June 1st. Victorian Government Railways. Electric time-releasing mechanisms. (B.X. 3431.)*
July 5th. One 15,000-kW steam turbo-generator and accessories. (B.X. 3338.)*
Sydney. — May 9th. Electricity Department. Station auxiliary switchgear. (B.X. 3338.)*
April 26th. A.C. electricity meters. (B.X. 3407.)*
June 22nd. New South Wales Government Railways. Remote control switchgear. (B.X. 3442.)*

Barking.—May 9th. County of London Electric Supply Co., Ltd. Cables and accessories for the Barking power station. (April 1st.)

Belgium.—April 28th. Schaerbeek Municipal Council. 11 kilometres of h.p. and l.p. armoured cable. Particulars (Cahier des Charges), for 10 francs from Service de l'Electricité, Hotel Communal, Schaerbeek.

May 9th. The Limbourg Provincial authorities at Hasselt. 1648.5 metres of h.p. armoured cable for Eysden. Particulars (Cahier des Charges), for 10 francs from Service de l'Electricité, 27, Avenue Bamps, Hasselt.

Colombia. — Bogota. — April 30th. Ministry of Public Works. Two electric lifts. (A.X. 4433.)*

Dublin.—April 30th. Electricity Department. E.h.p. and l.p. cables, cast-iron and stoneware troughing, section pillars, compound and other materials and accessories. (April 15th.)

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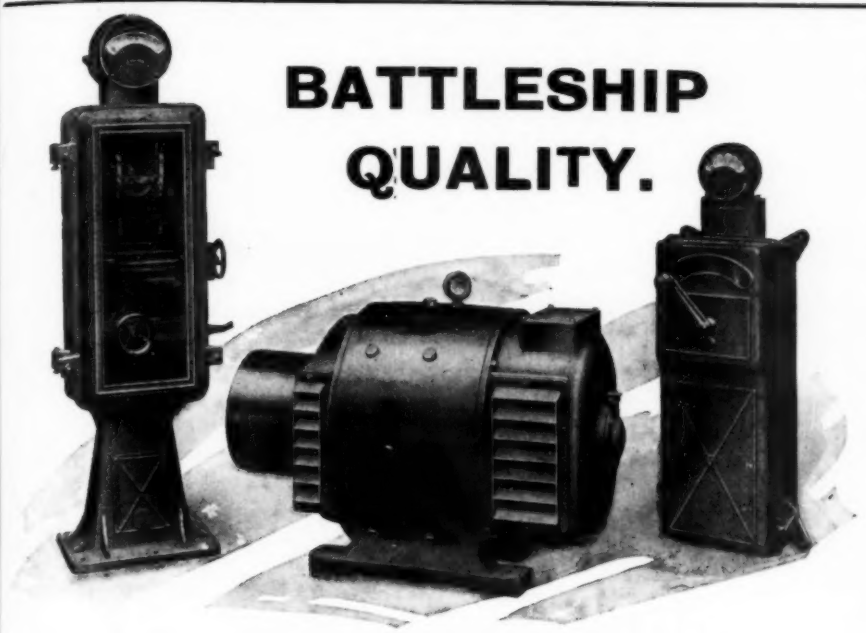

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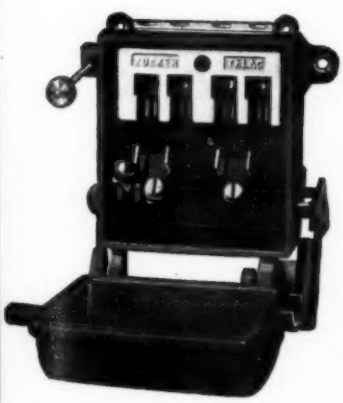

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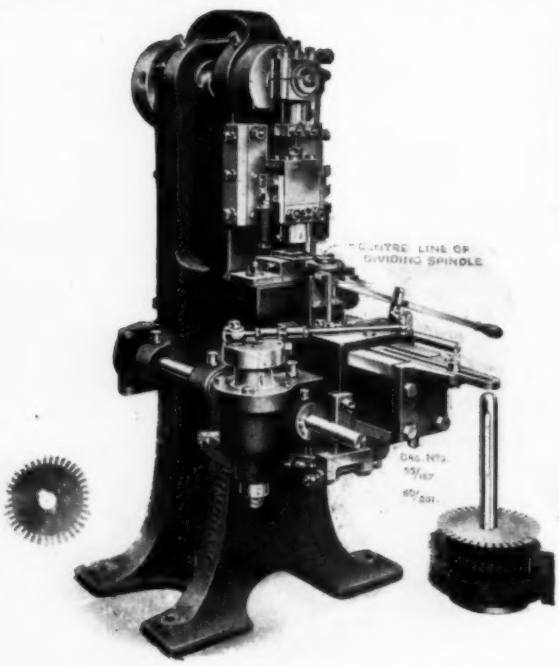

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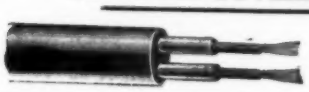

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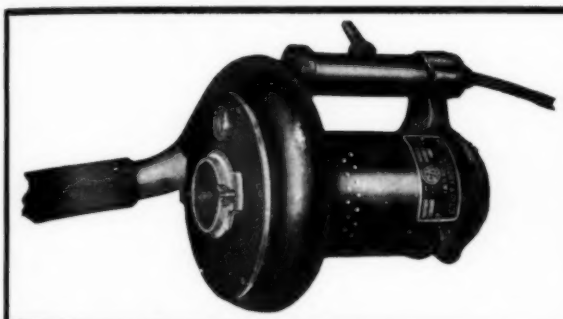

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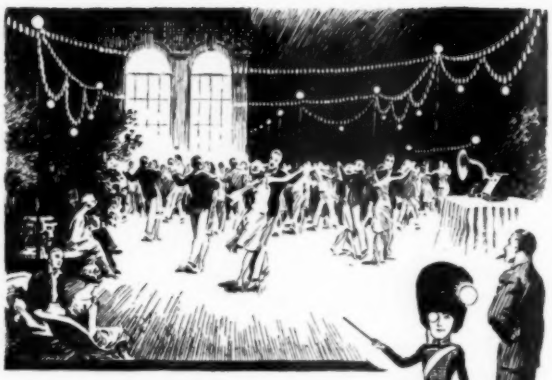

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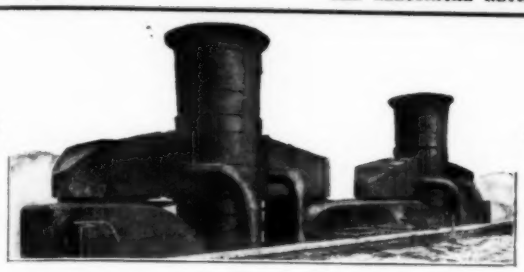

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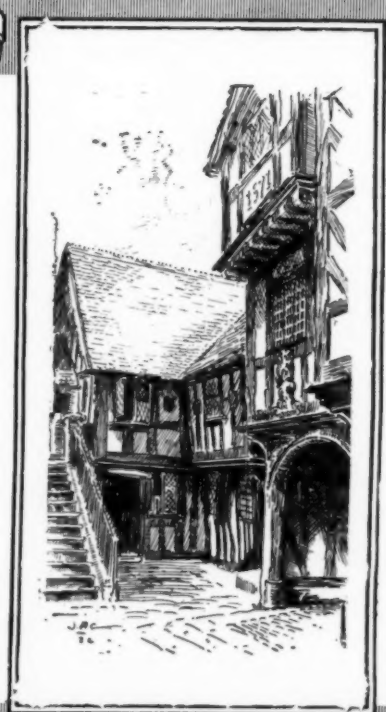

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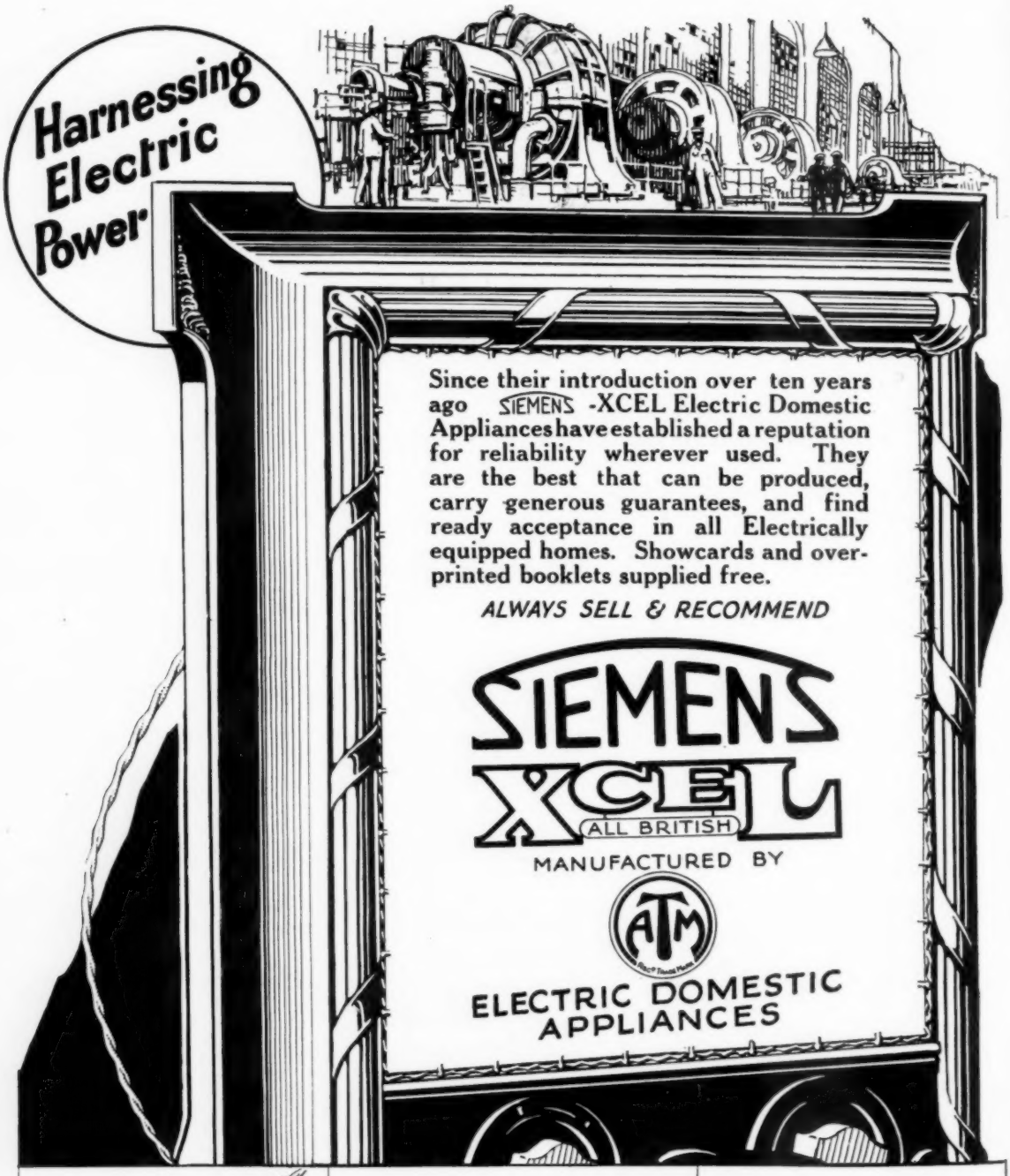
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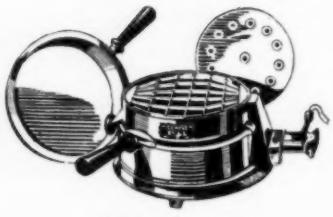

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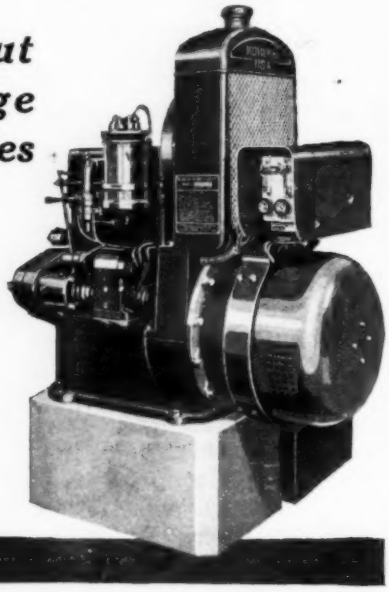

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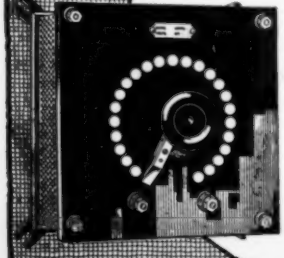

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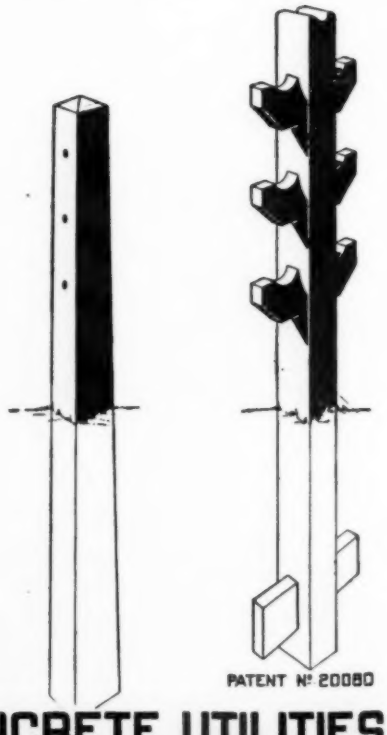

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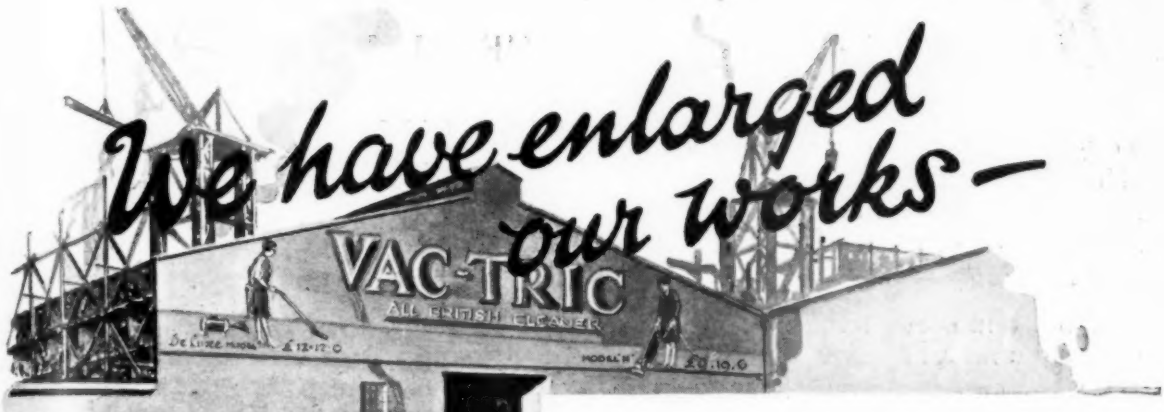

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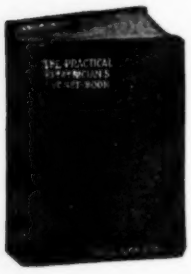

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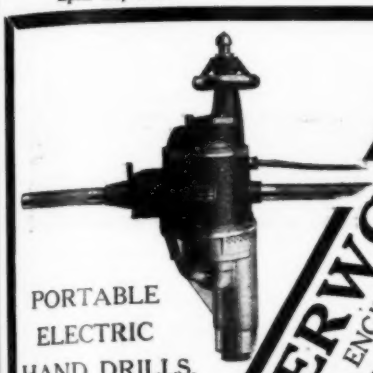

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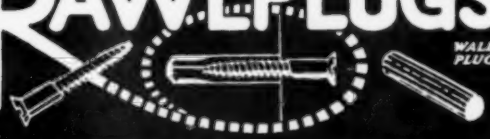

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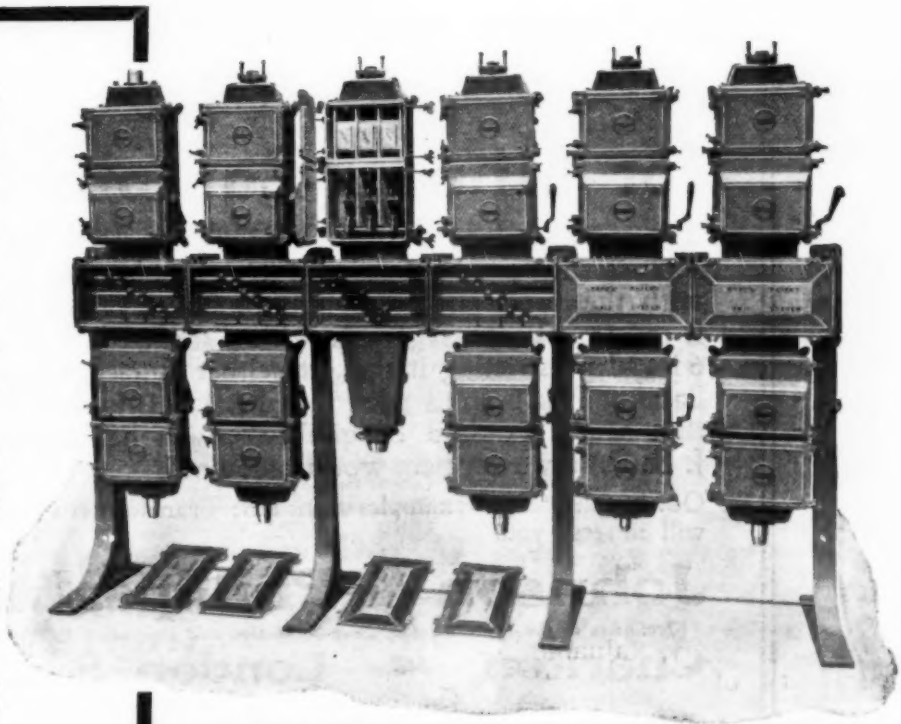

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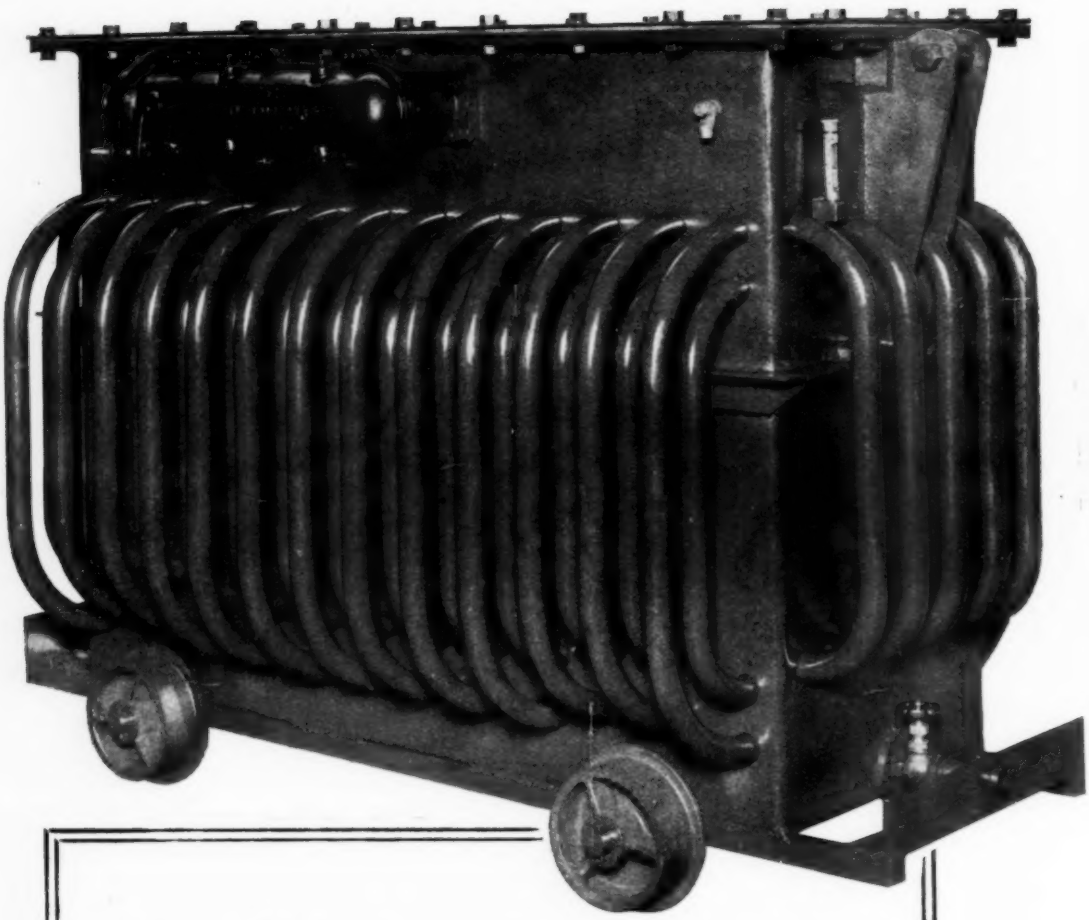

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"Resolved that as the operation of the N.J.B. Schedule should at this period have ensured a certain measure of standardisation in the technical staff arrangements of Electricity Supply Undertakings, this National Joint Board is of the opinion and recommends that all undertakings over 1,000 kW capacity should, when advertising vacancies on their technical staffs, state definitely the grade and minimum salary attaching to such positions."

All Members of the Association and other Engineers are urged to give active support to the above agreed recommendation of the National Joint Board by refraining from applying for any position unless the appropriate grade and minimum salary for the post is mutually agreed with the prospective employers.

(Signed) W. ARTHUR JONES,
General Secretary.

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CHARGE-Hand Electrician, age about 35, with experience of turbo-generators, rotary convertors, transformers, motors, switchgear, and wiring, required to undertake care and maintenance of a small generating station and power and lighting installation. State age, experience, and salary required.—3333, Electrical Review, 4, Ludgate Hill, London.

COMMERCIAL Association, Assistant wanted, used to preparation of minutes, précis and report work. Some technical knowledge essential; recent experience in electricity supply desirable; age not over 35; salary about £400. State education, training, and occupations in recent years; applications treated in confidence.—7933, Electrical Review, 4, Ludgate Hill, London.

CONSULTANT requires London Office Assistant. Electrical test bed experience essential. Knowledge of electrical machinery design desirable.—State age, experience, salary required, to 7874, Electrical Review, 4, Ludgate Hill, London.

DRAUGHTSMAN wanted for Electric Heating and Cooking Apparatus. Some previous experience on this class of work essential.—State age, experience, and salary required, to The Jackson Electric Stove Co., Ltd., Clifton Road, Luton. 3298

DRAUGHTSMAN, with general switchgear and control gear experience. State age, experience, and salary required.—3340, Electrical Review, 4, Ludgate Hill, London.

ENGINEER, to take charge of small works. Speed-man. Knowledge of drawings and calculations. Give details of experience, wages.—3326, Electrical Review, 4, Ludgate Hill, London.

ESTIMATOR required electrical contracting and manufacturing work, well educated, age 25 to 30.—Write, giving full particulars of experience and salary required, Box 873, Sells, 168, Fleet Street, E.C.4. 7998

FIRST-Class Man required to design, develop, and produce fractional h.p. electric motor.—Reply, giving all details of experience, age, married or single, and salary required, to 3296, Electrical Review, 4, Ludgate Hill, London.

JUNIOR Tracer required (male or female) for temporary engagement with firm of Electrical Engineers in Westminster.—Experience, age, and salary required, to 3323, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVE for London and Home Counties, and Branch Managers for Yorkshire and West of England required by manufacturers of E.L.M.A. lamps. Excellent opportunity for able man.—Please state full particulars, past experience, &c., to 3338, Electrical Review, 4, Ludgate Hill, London.

REPRESENTATIVES with good connections required for West of England, Midlands, South Wales, and Ireland, by London manufacturers of loud speakers.—Box 22, Parrs, Craven House, Kingsway, London, W.C.2. 3244

REQUIRED in the Manchester district, Sales Engineers, for the preparation of tenders for all classes of electrical machines, and control gear.—State age, experience, and when available, to 3284, Electrical Review, 4, Ludgate Hill, London.

SALESMAN (Outside) in London for low-tension automatic controllers; a.c. and d.c. Some connection preferred.—Please state approximate terms and when disengaged to 3230, Electrical Review, 4, Ludgate Hill, London.

SALES Representatives on commission basis only required by a first-class firm for handling automatic control gear in the following districts:—London, Cardiff and South Wales, Bristol and West of England, Sheffield, Derbyshire, Manchester and the Lancashire districts, Glasgow, Edinburgh, Dundee, Aberdeen, Dublin and Belfast. Only first-class men need apply. State technical qualifications and commission required.—3306, Electrical Review, 4, Ludgate Hill, London.

SUPPLY Company's Undertaking in West of Scotland requires an Assistant having a.c. experience and a sound knowledge of meters and mains. Wages £18 per month.—Apply, with full particulars, to 3303, Electrical Review, 4, Ludgate Hill, London.

THE Advertisers are looking for an experienced go-ahead Man to take full charge of their Bakelite Moulding Department. The firm is small, but offers progressive opportunities. Qualifications: Actual moulding, estimating, die design (but not necessarily manufacture). Strict disciplinarian, with push and go. Midlands.—Full particulars, in confidence, to 3319, Electrical Review, 4, Ludgate Hill, London.

SITUATIONS VACANT.—*Continued.*

TRAVELLER required for London area, specialising in electrical equipment. No objection to one already handling non-competitive line. Must be able to produce results. Expenses and commission.—Apply by letter only, with full particulars, to L. Weekes (Luton), Ltd., 121, Kingsway, W.C.2. 3292

VACANCY occurs for Pupil in electric 3-phase, a.c. supply station. Berkshire town.—7927, Electrical Review, 4, Ludgate Hill, London.

WANTED in Midlands, Armature Winder, used to repairs and rewinds to all kinds of 3-phase motors, and experienced in oxy-acetylene and electric welding. Must be 6 o'clock man.—Full particulars to 3286, Electrical Review, 4, Ludgate Hill, London.

WIRELESS.—From £5 to £12 a week can be earned by competent men able to act as full or spare-time Representatives for well-known wireless manufacturers. Applicants must have knowledge of wireless installation and be able to furnish good references. An excellent opportunity for highly remunerative work for enthusiastic men. Applications will be treated in confidence.—Write 948, Electrical Review, 4, Ludgate Hill, London.

APPOINTMENTS FILLED.

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision. We will then insert a notice free of charge under this heading.

COUNTY Borough of Croydon (Shift Charge Engineer); Box 2739 (Estimating Engineer); London Electric Wire Company and Smiths, Ltd. (Sales Manager); Box 2940 (Engineer).

SITUATIONS WANTED.

Advertisements are inserted under this heading at 1½d. per inch.

TO MANAGING DIRECTORS, PRINCIPALS AND OTHERS.

KEEN Engineer, age 30, desires to make a change for a position where organising ability and practical experience could be utilised to better advantage. 11½ years' experience with leading firms as Production Engineer and Designing Engineer, dealing with various types of electrical apparatus. Modern ideas on works management and organisation. Could undertake management of moderate size works.—Full details supplied on application to 7968, Electrical Review, 4, Ludgate Hill, London.

SALES ORGANISER.

A COMPETENT Sales Organiser, at present engaged, offers his services to enterprising manufacturing or wholesale electrical firm who are desirous of increasing their business. Advertiser possesses very important connection and thorough knowledge of electrical trade in Great Britain.—7909, Electrical Review, 4, Ludgate Hill, London.

Cheap prepaid Advertisements are inserted under this heading at the rate of One Penny Per Word (minimum 1s.). Three Consecutive Insertions for the price of two, if ordered and prepaid with first insertion.
Box Number and ELECTRICAL REVIEW address count as seven words.

A CAPABLE Mains Engineer (35), technical education, requires position, contract or municipal; excellent experience and references. Had control of large jobs (200 men), expert jointing, sub-stations and equipment, e.h.t., all protective devices, l.t., 3-phase, 4 and 7 core, and d.c., three-wire distribution, estimating and mains record. Can control men and get things done; 16 years' experience mains; ex-service. Accept anything, anywhere. Urgent.—7975, Electrical Review, 4, Ludgate Hill, London.

A PLUMBER-Jointer Electrician, conversant h.t.-l.t. jointing, general mains routine, and consumers' installations, seeks appointment with supply undertaking, London or Provinces.—7979, Electrical Review, 4, Ludgate Hill, London.

A POSITION required in the South of England as Working Manager of small electricity undertaking, with option of financial interest.—7961, Electrical Review, 4, Ludgate Hill, London.

A SKILLED Electrical and Mechanical Engineer, experienced, estate, works, pumping stations, or small electric supply company, steam, oil, Diesel engines; capable all repairs, maintenance. Married.—Abbott, Winders Hill, Godstone, Surrey. 7880

SITUATIONS WANTED.—*Continued.*

ADVERTISER (34) desires change, progressive position, armature winder and electrical fitter; has a good all-round experience of light and power maintenance; conscientious.—7935, Electrical Review, 4, Ludgate Hill, London.

AN Electrical and Mechanical Engineer, working, with exceptional experience factory maintenance, desires similar position.—Wilmir, 303, Morland Road, Croydon. 8007

AN Electrician (28), competent and reliable, requires change; installations, mains, erection of complete plant, or maintenance.—7922, Electrical Review, 4, Ludgate Hill, London.

AN Engineer (26) desires position, works or City office; 10 years' works experience, design, test motors, control gear; interviewing, correspondence. Capable, dependable, and energetic.—7876, Electrical Review, 4, Ludgate Hill, London.

AN Expert, design and manufacture of electricity meters, desires change. Full particulars.—7914, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winding Foreman desires position; a.c. and d.c., h.t. or l.t.; insulation expert.—7643, Electrical Review, 4, Ludgate Hill, London.

ARMATURE Winder, a.c. and d.c.; 16 years' experience. Repetition or repair (half week taken).—7887, Electrical Review, 4, Ludgate Hill, London.

DISENGAGED Engineer (35), desires position; 14 years' experience in charge boilers, engines, turbo-generator, refrigerating machinery, pumps, &c.—7978, Electrical Review, 4, Ludgate Hill, London.

DRIVER seeks situation, preferably Brush-Ljungström turbine.—7888, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer, age 45, thoroughly experienced in power plant maintenance, gravel pumps, elevating machinery, fault localising, radio experience, and automobile engineering.—F.36, Bernard Street, Russell Square, W.C.1. 8011

ELECTRICAL Engineer (39), ex-officer; 20 years' technical, commercial, erection and engineer salesmanship experience a.c., d.c. motors, generators, control gear all kinds; desires position. At present disengaged; excellent references.—7853, Electrical Review, 4, Ludgate Hill, London.

ELECTRICAL Engineer of wide experience and a knowledge of international affairs seeks a change of work. Experience covers power station work, metallurgical mining, some electro-metallurgy, purchasing agency, and sales, with much general business. Position sought is one where these qualifications, together with a sense of responsibility, would find scope. Satisfactory references.—7919, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, all round, long practical experience; all branches.—Write Powell, 70, Standen Road, S.W.18. 7987

ELECTRICIANS (3), want piece or contract work. Lighting, 'phones, bells, or power—Cowling, 22, White Lion Street, E.1. 'Phone: Central 7175. 7847

ELECTRICIAN requires berth; good references.—R. Pope, 11, Sharsted Street, S.E.17. 7985

ELECTRICIAN, used to house wiring, factory, oil engines, batteries, &c., town or country.—C., 9, Ripplevale Grove, Barnsbury, N. 8006

ELECTRICIAN'S Mate wants job (good practical).—F. Summers, 13, Archibald Place, Farm Street, W.1. 7986

ELECTRICIAN, good reliable man, all branches; capable charge hand. Rate 1s. 8d.—7970, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN'S Wireman's Mate, 2½ years' experience, handy every branch of trade, seeks situation.—7971, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN, with mechanical knowledge, maintenance or contracting; 15 years' experience; age 32.—W.M., 29, Blenheim Street, Chelsea, S.W.3. 7977

ELECTRICIAN Improver seeks situation; 5 years' experience.—"Electrician," 77, Collard Road, Walthamstow, E.17. 7883

ELECTRICIAN, lead covered specialist, and all branches.—11, Jewel Street, London, E.1. 7877

ELECTRICIAN, age 32; 14 years' varied experience. Could take charge.—Croser, 4, Cobham Road, Wood Green, N.22. 7873

SITUATIONS WANTED.—*Continued.*

ELECTRICIAN (21) seeks situation; used to all classes of wiring, maintenance and repairs; permanency preferred. Rate 1s. 3d.—7918, Electrical Review, 4, Ludgate Hill, London.

ELECTRICIAN Millwright, experienced in economical equipment and maintenance of factories and works.—G.A.E., 171, Malmesbury Road, Bow, E.3. 7957

ENGINEER, with established connection, London and South, is open to represent one or two firms of repute. Own car and telephone.—7411, Electrical Review, 4, Ludgate Hill, London.

EX-Officer, University graduate, with three years' experience installations, estimates, and testing, requires post at home or abroad. Contractors or consultants. Reasonable remuneration required. References and testimonials.—7911, Electrical Review, 4, Ludgate Hill, London.

EXPERT Shorthand-Typist, 14 years' varied electrical experience, seeks change.—7871, Electrical Review, 4, Ludgate Hill, London.

LEDGER Clerk or Secretary's Assistant, capable; many years' experience in all departments; wide and valuable knowledge of trade clientele. Excellent testimonials.—Elma, 5, Edgeley Road, Clapham, S.W. 7868

MAINS Foreman or h.t. Plumber-Jointer wants situation; all classes of cables, telephone, super tension and l.t. work; excellent references; hard worker; home or abroad.—7852, Electrical Review, 4, Ludgate Hill, London.

MANAGER, Contractor's or works plant, age 38. A man of character and virile personality. Practical, theoretical, and business experience, all branches; good efficiency curve covering 22 years. Salary £5.—7972, Electrical Review, 4, Ludgate Hill, London.

PLUMBER-Jointer (21), live worker, 8 years' electrical experience, desires change.—7973, Electrical Review, 4, Ludgate Hill, London.

PYROMETERS. Instrument Maker, experienced in the practical application and running of high and low temperature pyrometers, automatic control, recorders, &c., is open for position with firm using or making such apparatus, on testing, adjusting, or experimental work.—Address, Fulton, 135, Kent Road, Glasgow. 7982

SUPERINTENDENT, wide experience economical mass production of small electrical assemblies. Works organisation, tools, jigs and methods. Highest written and personal references.—8010, Electrical Review, 4, Ludgate Hill, London.

TELEPHONE Engineer (38), having wide experience in the design and installation of telephone and signalling apparatus, &c., seeks post. Exceptional experience in the localisation and correction of faults. Live worker.—7869, Electrical Review, 4, Ludgate Hill, London.

WAGES and Costs Clerk, 15 years' experience; thorough knowledge of bookkeeping, good correspondent; excellent references; age 30.—7983, Electrical Review, 4, Ludgate Hill, London.

WIREMAN, good hand, thoroughly reliable.—"Electrician," 19, Bryantwood Road, London, N.7. 7939

WIREMAN, good, wants work; town or country.—Long, 49, Alexander Road, N.19. 7989

WIREMAN, experienced, disengaged; lighting and power, &c.—G.H., 150, Windmill Road, Brentford. 7988

WIREMAN, disengaged; general experience, maintenance, jobbing.—T. W. Pendred, 62, Byron Avenue, East Ham. 7958

FOR SALE.

Advertisements are inserted under this heading at 1½s. per inch.

DIESEL ENGINES.

SEVERAL unused, 2,000/3,000 b.h.p., M.A.N. Diesel Engines for disposal at attractive prices.

These engines are especially suitable for dealing with peak and emergency loads in large power stations, or as the main generating sets in moderate size stations. Immediate delivery.

Full details from J. W. R. WRIGHT, 66, First Avenue, Gillingham, Kent. 3160

FOR SALE.—*Continued.*

EXCELLENT ELECTRICAL PLANT FOR DISPOSAL.

350-KW Rotary Convertor, 50 cycles, 6-phase, 750 r.p.m., 480/460 volts, 730 amps., by Vickers, Sons & Maxim.
380-kVA Transformer, B.W.E., 50 cycles, with tank complete, 6,700/333 volts.
300-kW Rotary Convertors (three), compound wound, 440/540 volts, 3-ph., 25 cycles, 500 r.p.m., with 3-ph. Induction Starting Motor, 300 volts, mounted on armature shaft.
110-kVA Transformers (nine), single-phase air blast, 2,860/2,660 to 320/295 volts, for above convertors.
250-kW Motor Generator, G.E.C., 50 cycles, 460/550 volts, 340/450 amps., 750 r.p.m.
550-kVA Transformer, Johnson & Phillips, 50 cycles, 3-ph., 5,500/356 volts, 575/56 amps., with tanks.
Balancer, E.C.C., 100 amps., 230/250 volts, 900 volts, bi-polar.
Booster, E.C.C., 100 amps., 90 volts, 1,220 r.p.m., bi-polar.
Booster, E.C.C., 130 amps., 220/110 volts, 800 r.p.m., bi-polar.
6-h.p. Stellite Motor, 460 volts, 900 r.p.m.
25-h.p. E. & O.A., 460 volts, 1,050 r.p.m., and spare arm.
2½-h.p. Electromotors Motor, 460 volts.
10-h.p. L.D. & M. Motor, 460 volts, 610 r.p.m.
7-h.p. L.D. & M. Motor, 230 volts, and spare arm.
1-h.p. Bruce Peebles Motor, 460 volts, and spare arm.
5-h.p. Rhodes Motor, 460 volts.
25-h.p. Vickers Motor, 3-ph., 50 cycles, S.R. for 350-kW convertor.

All above lying in Birmingham District.

105-kW Steam-Electric Generating Sets (three), Peter Brotherhood-Laurence, Scott, 105 volts, 1,000 amps., 400 r.p.m.
105-kW Oil Engine, Electric Generating Sets (two), Hornsby-Laurence, Scott, 105 volts, 1,000 amps., 400 r.p.m.
Large number of 100- and 110-volt Motors, by Stellite, Laurence, Scott, &c.

Above items at Newport, Mon.

200-kW Motor Generator Set, comprising 300-h.p., 440-volt Motor, compound wound, direct-coupled to 200-kW, 110-volt Generator, shunt wound, by E.C.C.
3, 8, 10, 15, 20 and 30-h.p. Motors, for 400 volts supply, with Starting Gear, by first-class makers.
½-h.p. to 25-h.p. Motors, for 220 volts supply.

In Stock at Great Bridge.

Send for further particulars to—
JOHN CASHMORE, Great Bridge, Staffs.
3283

FOR SALE.

ONE 110-volt, 5-kW, Protected type, shunt wound Dynamo, with interpoles, complete with pulley.

One Black Enamelled Slate Switchboard, having mounted thereon main switch cut-outs and shunt regulator for the dynamo, also automatic cut-out and the usual charge and discharge switches.
One Generator Voltmeter.
One Battery Voltmeter.
One Generator Ammeter.
One Resistance Control.

All complete with copper interconnections between units at back of board.

Also 56 Accumulator Glass Cells, 7 in. long by 5 in. broad by 11 in. deep, with 212 glass feet.

Price moderate.

Apply:—3304, Electrical Review, 4, Ludgate Hill, London.

FOR SALE.

TWO Carels 320-h.p., 4-cylinder Diesel Engines, 175 r.p.m., coupled to—

Two Dick, Kerr 200-kW, 500/550-V, d.c. Generators, also switchboard, instruments, cooling water and fuel oil tanks, and Premier wooden natural draught open type water cooler.

One Reversible Booster, by Lancashire Dynamo Company, 0/150 V, 220/460 amp., 770 r.p.m., with switchboard.

One 10-ton Overhead Travelling Crane, by Herbert Morris and Bastard, Ltd.

Above plant all in good condition, comprising the complete equipment of a small 500-V, d.c. generating station, may be inspected by arrangement.

Apply Yorkshire (West Riding) Electric Tramways Co., Ltd., Belle Isle, Wakefield. 3309

MOTORS AND DYNAMOS.

400 IN STOCK.

Guaranteed and on approval.

GREENHALGH BROS., ATHERTON.
864

MYLAN & SMITH (ENGINEERS), LTD.
KELVIN HOUSE,
St. James' Street, Sheffield.

Every Item in our own Stock.
All Guaranteed for Six Months.

Thoroughly overhauled and tested before despatch.

THREE-PHASE, 50 PERIODS, 400/440 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	15	960	slip-ring	Phœnix
One	25	720	,,	G.E.C.
One	30	725	,,	,,
One	45	975	,,	B.T.H.
Six	45	940	,,	Fuller
One	50	955	,,	Newton Bros.
One	70	485	,,	Mather & Platt
One	100	583	,,	E.C.C.
One	100	575	,,	L.D. & M.
Two	125	485	,,	Brush
One	160	241	,,	E.E. Co.
Two	200	733	,,	Newton Bros.
One	330	575	,,	Westinghouse
One	440	490	,,	E.C.C.
One	10	950	squirrel cage	Brook
Two	20	1420	,,	L. D. & M.
Two	20	940	,,	,,
One	27	570	,,	E. C. Co.
Two	30	750	,,	Brook
Three	50	964	,,	Newtons
One	50	480	,,	L. D & M.
One	60	965	,,	Newtons
Three	60	720	,,	L. D. & M.
One	75	970	,,	Newton

DIRECT CURRENT, 110 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	9	425	compound	Crompton
One	10	375	shunt	G.E.C.
One	12½	800	compound	Mather & Platt
Two	18	450	,,	Westinghouse
Two	21½	275/400	shunt	Verity
One	24	260	,,	Greenwood & B.

DIRECT CURRENT, 220/230 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	12	400/800	shunt	Verity
One	15	435	,,	Mawdsley
One	18	850	compound	Crompton
One	20	750	shunt	G.E.C.
One	20	610	,,	Newtons, T.
One	20	500	,,	Crompton
Two	20	300	,,	Vickers
One	23	425	,,	Greenwood & B.
One	25	1600	compound	Mather & Platt
One	25	460	shunt	,,
Two	28	220/330	compound	Electromotors
Two	36	900	,,	Westinghouse
One	40	750	shunt	Verity
One	43	550/800	,,	,,
One	47½	580	,,	Greenwood & B.
Two	48	270	,,	Phœnix
One	300	490	,,	E.C.C.

DIRECT CURRENT, 440/500 VOLTS.

Stock.	H.P.	Speed.	Winding.	Maker.
One	10	1370	compound	Cutting
One	10	1000	shunt	Crompton
One	20	975	,,	Cutting
One	25	830	,,	Siemens
One	25	585	,,	L. D. & M.
One	30	875	,,	Mawdsley
One	30	535	,,	L. D. & M.
One	40	950	,,	Crompton
One	40	880	,,	E.C.C.
Three	40	600	,,	Vickers
One	40	350	compound	Met.-Vick.
Two	45	800	shunt	Laurence, Scott
One	45	685	,,	L.D. & M.
Two	50	920	,,	Mather & Platt
Four	56	440/660	compound	Electromotors
One	70	550	,,	Phœnix
One	80	900	shunt	E.C.C.
One	180	250	,,	E.E.C.

Our Stock also includes:
Over one hundred machines below 10 h.p. and other sizes of machines for practically all circuits not stated above.

A Selection from the Miscellaneous Section of our Stock.

STEAM ENGINE SETS.

130/150 lb. Compound Non-condensing.

ONE Bellias 35-kW, 220 volts, d.c., 520 r.p.m.
One Howden 120-kW, 220 volts, d.c., 355 r.p.m.

PETROL-PARAFFIN GENERATING SETS.

Large number of sets from 10 kW to 50 kW, all voltages from 80 to 500.

A.C. SWITCHGEAR.

One B.T.-H. 8-panel, black enamelled slate, 3-ph., 50 per., 440 volts board, six 3-pole, 200 amps. and two 3-pole, 500 amps. oil-immersed breakers (ammeter, power factor indicator and integrating wattmeter each panel), bus-bars, &c., complete.

Two B.T.-H. ironclad draw-out, truck type h.t. (3,300-volt) cubicles, each with 200-amp. O.I. circuit breaker, isolating switches, &c.

Five B.T.-H. type O.D.1 60-amp. circuit breakers.

D.C. BROOKHIRST PILLARS.

A large range of pillar type d.c. motor control panels for all voltages and any size up to 100 h.p.

SWITCHBOARD FITTINGS.

Circuit breakers, knife switches, instruments, &c., &c., in large quantities and new condition.

MAGNET.

One 36-in. diameter circular lifting magnet, reconstructed by Allen West & Co., Ltd., 220 volt, 25 amps., complete with chain and lifting shackle.

TRANSFORMERS, 3-PH., 50 PERIODS, OIL-IMMERSED, SELF COOLING.

One 368 kVA, 3,200/500-400 volts, Brush Co.
Two 1,000 kVA, 3,200/440 volts, B.E.T. Co.
Two 1,000 kVA, 6,600/440 volts, Ferranti.

PUMPS.

One British Electric Plant, 200 g.p.m., 150-ft. head Pump, with direct-coupled, 16-h.p., d.c. motor.
One Mather & Platt 115 g.p.m., 450-ft. head Turbo-pump, direct coupled to 25-30 h.p., 220 volt, d.c. motor.

REDUCTION GEARS.

Fifteen reduction gears for electric motor drives, worm and spur wheel type, all oil immersed, for powers from 1 h.p. to 100 h.p.; reductions up to 30 to 1.

STEAM, GAS AND WATER VALVES.

Several hundred brand new Hopkinson valves at less than half maker's prices. Priced catalogue on request.

ALTERNATOR.

One 200 kVA, 3-phase, 50 period, 500 volt, Rotating field, Bruce Peebles Alternator, with three pedestal bearings, bedplate, rope pulley, and direct-coupled exciter.

HIGH TENSION MOTORS.

Two 65 h.p., 1,450 revs., 3-phase, 50 period, 2,750 volt, slip-ring English Electric Motors.
One 160 h.p., 240 revs., 3-phase, 50 period, 2,000 volt, slip-ring English Electric Motor.
One 430 h.p., 500 revs., 3-phase, 50 period, 3,300 volt, slip-ring G.E.C. Motor.

The above represents only a Small Selection of our Stock.
Please send us your enquiries.

MYLAN & SMITH (ENGINEERS), LTD.,
Kelvin House, St. James' Street, Sheffield.
'Phone: 21371, 21372 Sheffield.
'Grams: "Topical" Sheffield.
Works: Bamford, Derbyshire, L.M.S. Railway. 3

FOR SALE.—*Continued.*

WINDER, &c., FOR SALE.

ONE Electric Winder for Sale, made by Robey, drum diam. 11 ft. 6 in., driven by a Siemens 255 h.p., a.c., 3-phase, 2,750-volt motor, with Siemens switchgear, Allen West control gear, complete with Robey air compressor for air brake.

Also one 200-h.p. and one 125-h.p. electrically-driven Main and Tail Haulers.

Also one Worthington Double Stage Air Compressor, 80 lb. pressure, 1,600 cubic feet free air per minute,

And a quantity of various classes of Colliery Plant.

For further particulars apply to:—

THE OWNERS OF REDHEUGH COLLIERY, LIMITED,

Phœnix House, 4, Queen Street, Newcastle-on-Tyne. 3294

COUNTY BOROUGH OF HALIFAX.

THE Tramways and Electricity Committee of the Halifax Corporation have for Sale two Weir Steam Turbo-driven Boiler Feed Pumps.

The above-mentioned plant can be seen at any time by appointment, and full particulars can be obtained on application to Mr. W. M. Rogerson, M.I.E.E., Borough Electrical Engineer, Town Hall Street East, Halifax.

Tenders for the above plant should be delivered to the undersigned not later than Saturday, the 7th May, 1927.

The highest or any tender not necessarily accepted.

By Order,
PERCY SAUNDERS,
Town Clerk.

Town Hall, Halifax.
20th April, 1927. 3313

LAMPS! LAMPS!! LAMPS!!!

Metal-filament, Half-Watt Type, Ferro Watt, Gas-filled Clear and Opal, Traction, Motor Car, Carbon and Candle Lamps.

DELIVERIES PROMISED AND MADE.

All Voltages and Wattages Stocked. Our Prices will Surprise You.

UNIVERSAL ELECTRIC LAMP CO.,
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ELECTRIC MOTORS AND DYNAMOS.

WE hold one of the largest Stocks of New and Second-hand Motors. Second-hand Machines are thoroughly overhauled. Inspection and Tests can be made at our Works.

For Sale or Hire. Send your inquiries to Messrs.

BRITANNIA MANUFACTURING CO., LTD.,
Registered Office and Works:
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CITY ROAD, LONDON, N.1.

Telephone: 5512-3 Clerkenwell. 13

MOTORS, DYNAMOS, TRANSFORMERS AND SWITCHGEAR.

HUGE stock-taking reductions. Large stocks of a.c. and d.c. Plant, all voltages and speeds. To be cleared at very low prices. All plant guaranteed and sent on approval. Inspection at our works invited. Please send inquiries.

MIDLAND COUNTIES ELECTRICAL ENGINEERING CO., LTD.,

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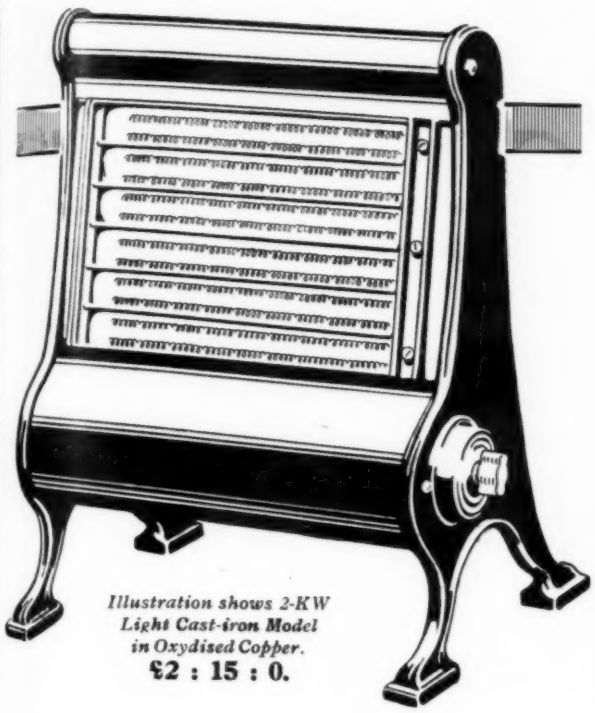

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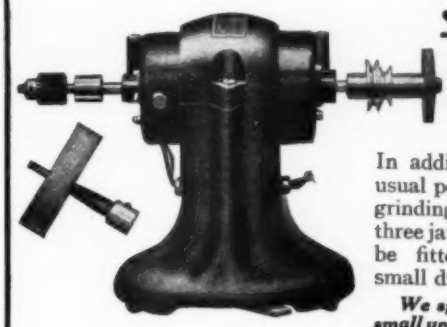

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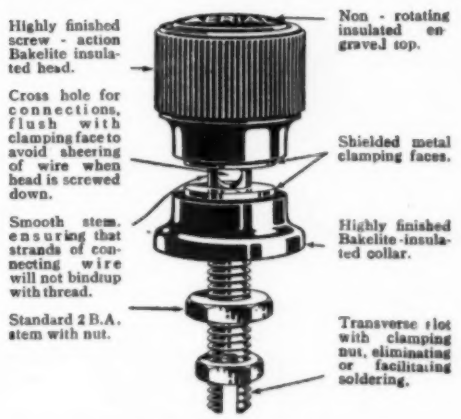
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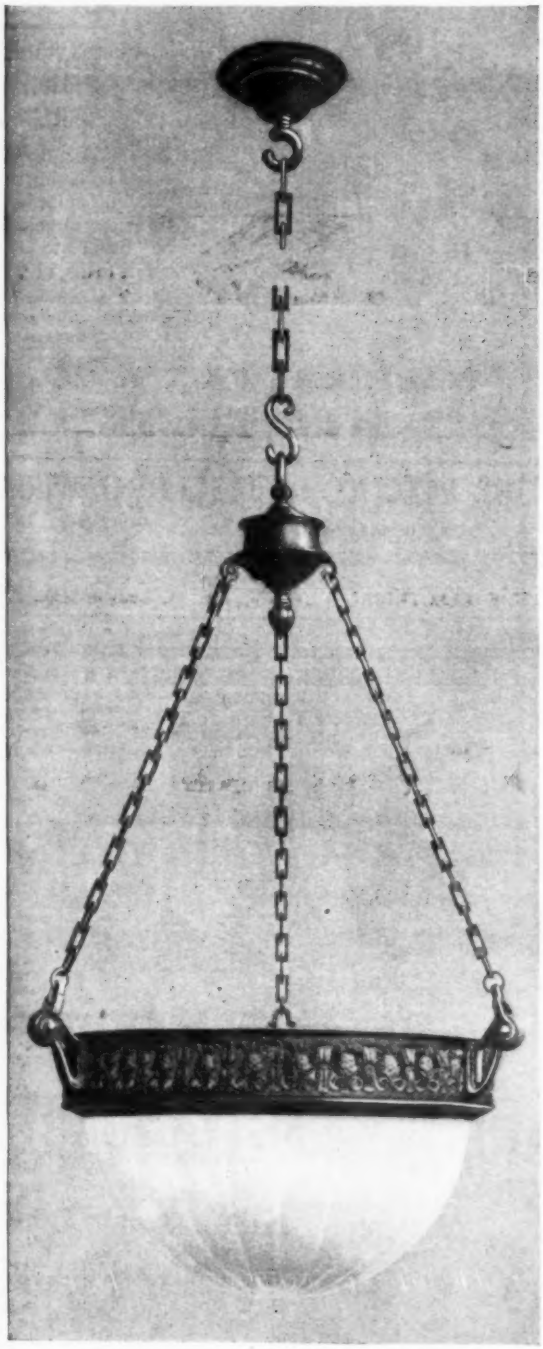

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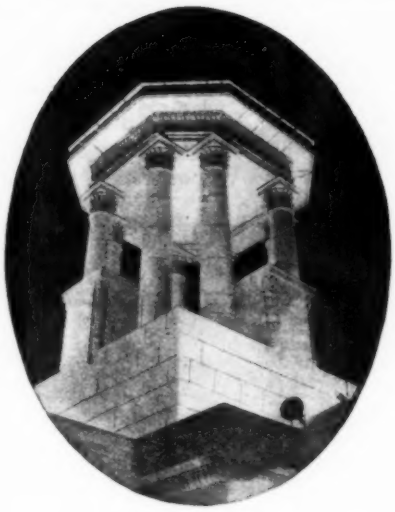

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Full particulars can be obtained from the undersigned, but no personal representation is to be made.

Tenders must be deposited with the Town Clerk not later than April 28th, 1927.

ROBERT BIRKETT, M.I.E.E.,
Borough Electrical Engineer and General Manager.

Borough Electrical Engineer's Office,
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April 12th, 1927. 3295

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P. M. HEATH,
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Town Hall, Manchester.
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By Order, C. G. E. FLETCHER, Town Clerk.

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April 13th, 1927. 3311

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Particulars of the proposed amendment were set forth in the Illustrated Official Journal (Patents), of the 13th April, 1927.

Any person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, within one calendar month from the date of the said Journal.

W. S. JARRATT,
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THE Proprietors of Patent No. 216,864, for "Improvements in or relating to Electric Furnaces," are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for purpose of exploiting same and ensuring its full development and practical working in this country.—Address all communications in first instance to Haseltine, Lake & Co., Chartered Patent Agents, 28, Southampton Buildings, Chancery Lane, London, W.C.2. 3301

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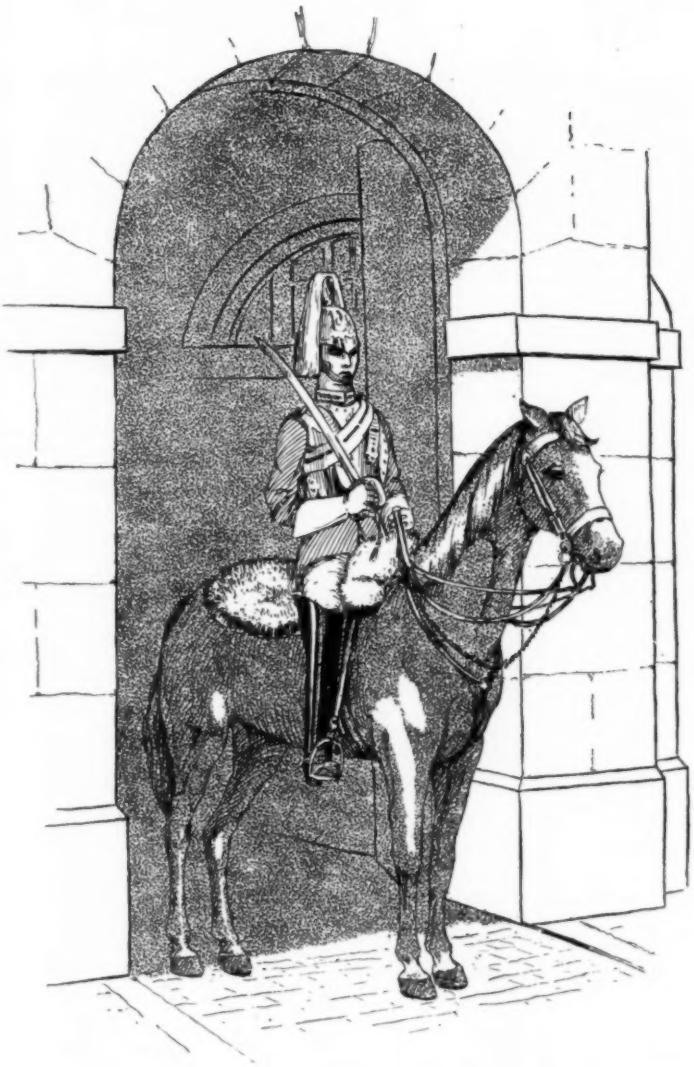

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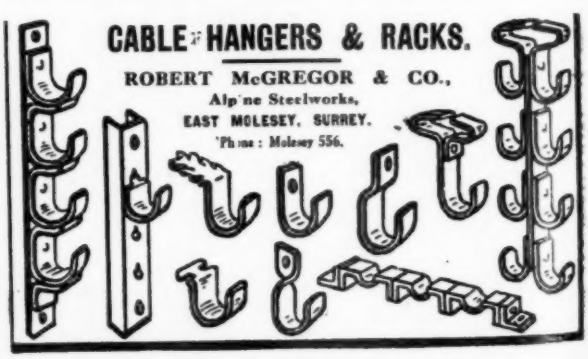

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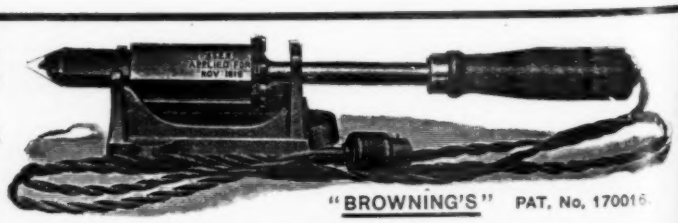

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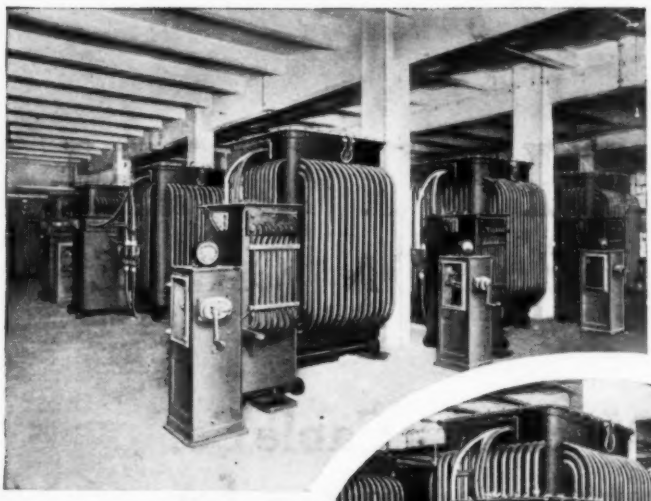

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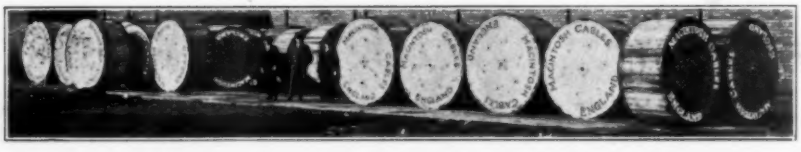

"Ducter" Test of Traction Motor, Durnsford Road Repair Depot, Southern Railway.

"Ducter" Test of Motor Armature, Peckham Rye Repair Depot, Southern Railway.

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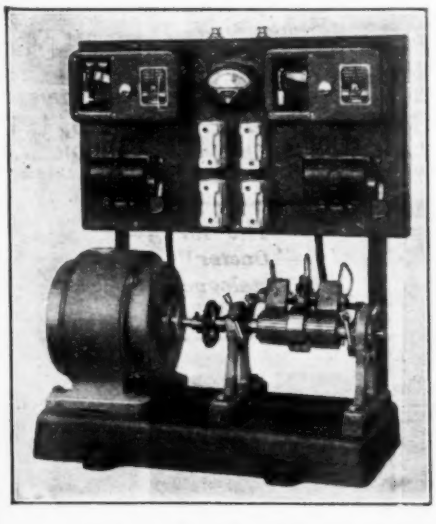

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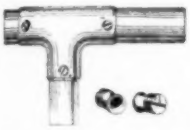

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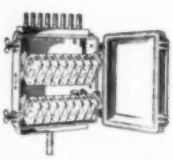

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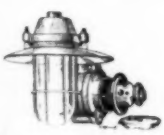

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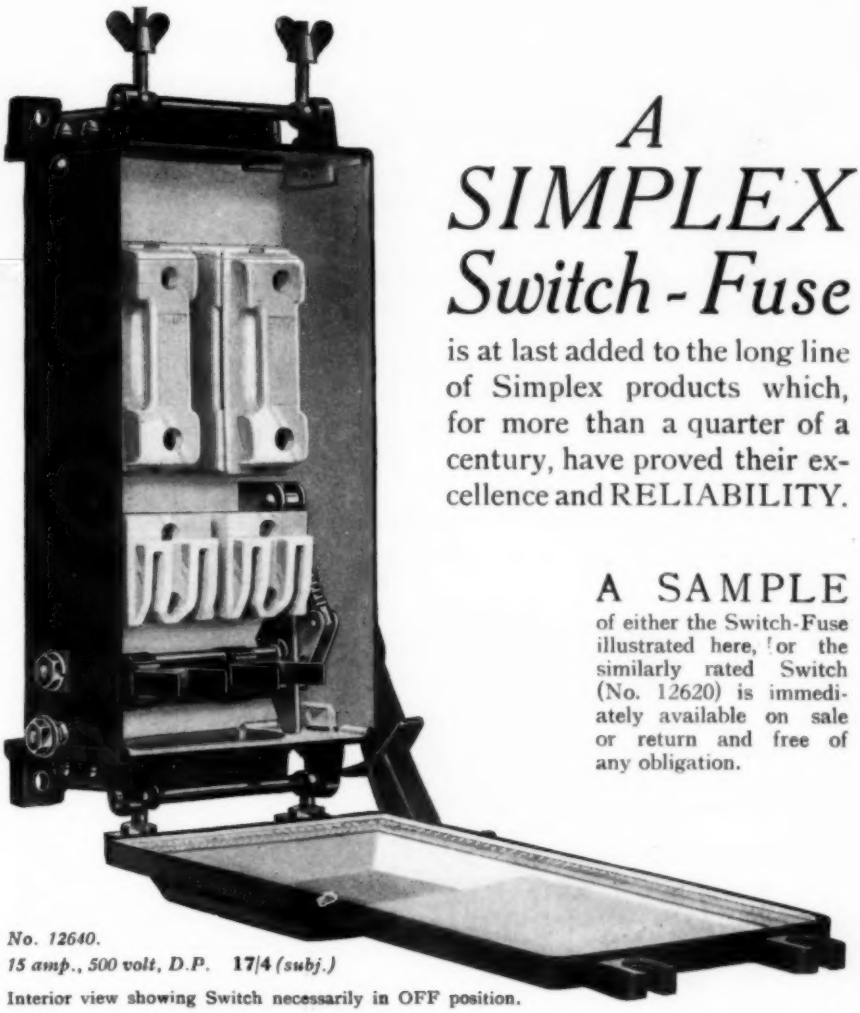

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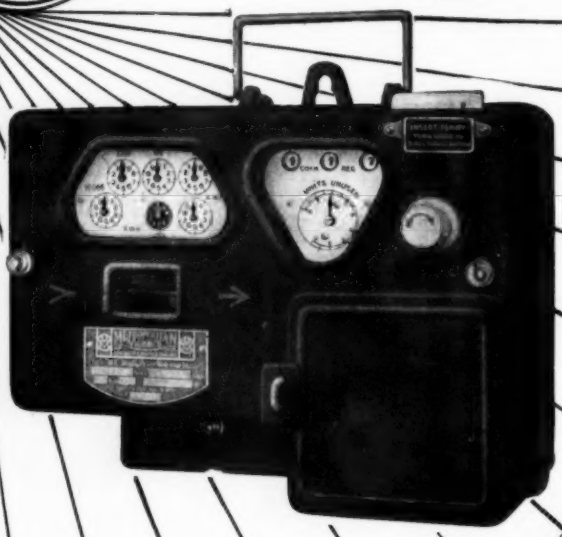

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Exactly similar to that of standard meter.

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The design of the moving parts is such as to reduce friction losses to a negligible value.

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The switch embodies the well known rolling contacts of the contactor type, and they cannot stick.

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Where necessary the cash side is sealed separately from the meter and recording side.

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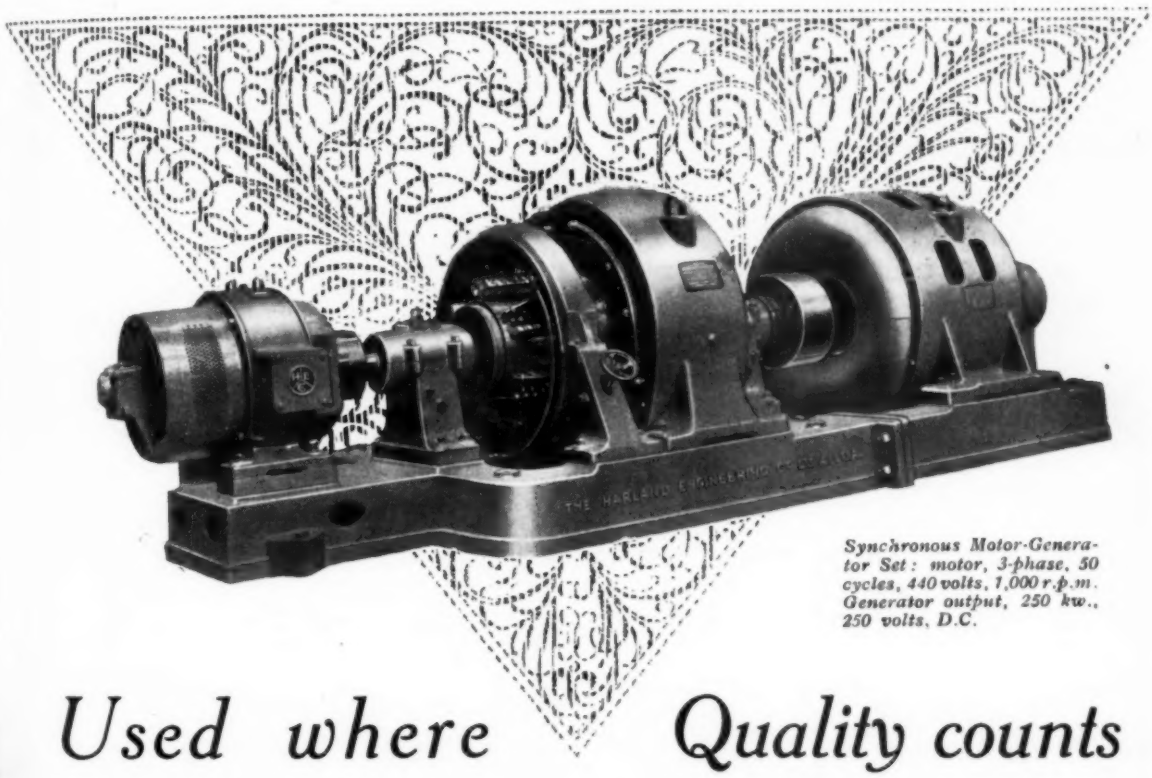

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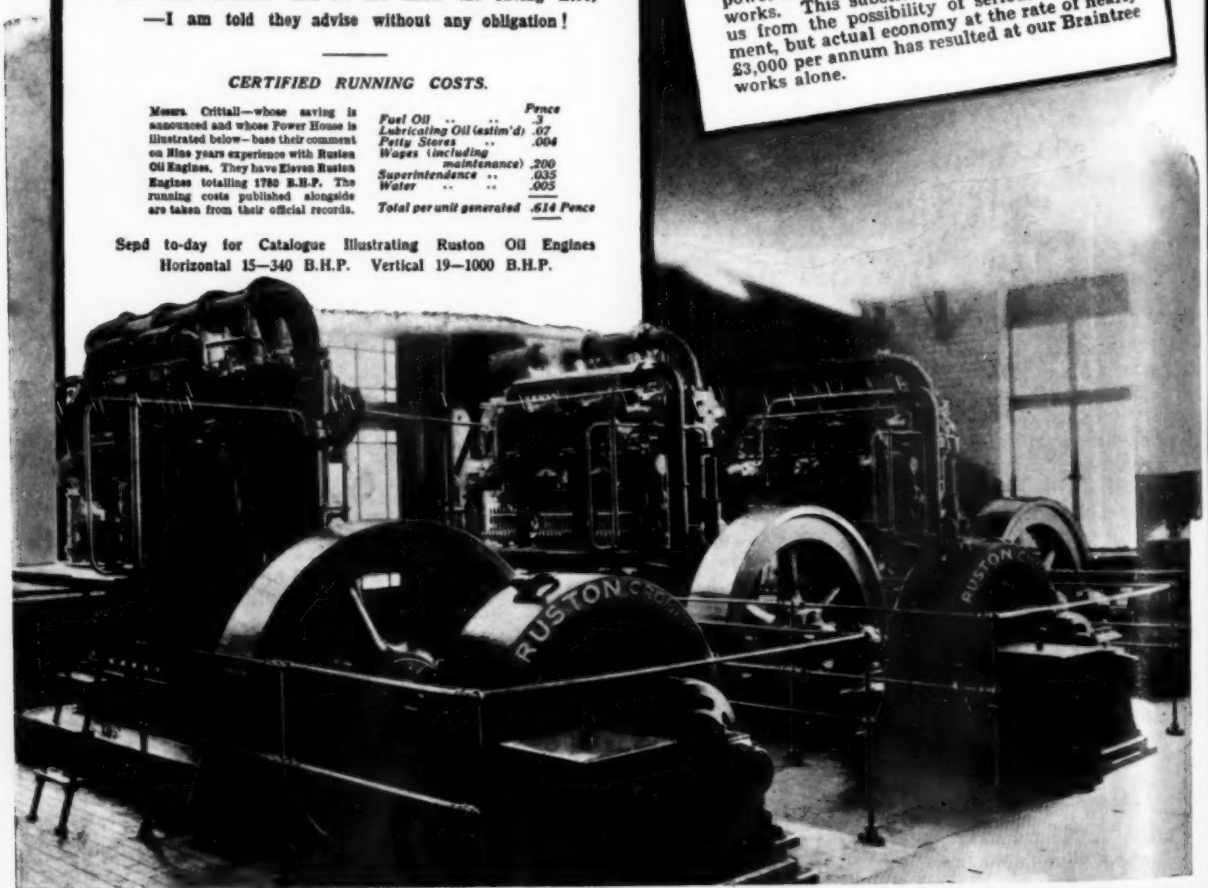

RUSTON & HORNSBY LTD. LINCOLN

Printed by THE PREMIER LINOTYPING AND PRINTING CO., LTD., 21-26, Dean Street, Fetter Lane, E.C., 4. and Published by THE ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

Edinburgh.—April 25th. Education Authority. Electric installation at North Junction Street School. Plans and schedules from office of the Authority.

May 2nd. District Board of Control. Electricians' work at new buildings at Gogarburn Institution. Mr. Stewart Kaye, architect, 14, Hill Street, Edinburgh.

Egypt.—CAIRO.—May 24th. Director-General of Prisons. Twelve months' supply of electric lamps, &c. (C.X. 2268.)*

Grimsby.—May 2nd. Electricity Department. E.h.p. and pilot cables; l.p. feeder cables. (April 15th.)

Ilford.—April 26th. Electricity Department. One 1,500-kW motor-convertor or rotary-convertor and transformer, 6,600-V switchgear cubicles and alterations to existing switchgear. (April 8th.)

India.—India Store Department. April 26th. 66-kVA motor-driven alternator sets, transformers, switchgear, &c. (April 1st.) Telephone cable. (April 8th.) 53,825 inert electric cells. (April 15th.)

Kendal.—April 30th. Board of Guardians. Electric light installation at the Institution; Mr. G. Cotton, clerk, 14, Lowther Street. (Returnable deposit of £2.)

London.—LONDON COUNTY COUNCIL.—April 26th. Wiring and fitting for electric lighting in two blocks of tenements at the Ring Cross housing estate, Islington (approx. 274 wiring points). (April 8th.)

ST. MARYLEBONE.—May 18th. Electricity Department. L.p. and e.h.p. cables for 12 months. (April 15th.)

METROPOLITAN ASYLUMS BOARD.—April 25th. Installation of electric lighting, telephone, fire alarm and domestic bells in the engineer's house at the Western Fever Hospital, Seagrave Road, S.W. (April 15th.)

ISLINGTON.—June 1st. Electricity Department. Steel-tube lamp columns, 2,200-V feeder switchgear, rotary and/or static power factor correctors. (See this issue.)

Manchester.—May 5th. Electricity Committee. Twelve months' supply of electric kettles, potential and current transformers, electricity meters, and cable supplies. (See this issue.)

New Zealand.—WELLINGTON.—May 31st. Public Works Department. 50-kVA transformers for the Waikaremoana electric power scheme. (B.X. 3294.)* 50-kVA transformer for Arapuni scheme. (B.X. 3293.)*

June 21st. Sub-station switchgear and metering equipment for Arapuni. (B.X. 3398.)*

June 7th. Railway sub-station equipment, Lake Coleridge electric power scheme. (B.X. 3295.)*

June 13th. New Zealand Railways. Machine tools, workshop equipment and overhead electric travelling cranes. (A.X. 4344.)*

June 6th. Six electric locomotives. (A.X. 4355.)* Overhead equipment for the Christchurch-Lyttelton electrification scheme. (B.X. 3301.)*

INVERCARGILL.—May 31st. Southland Electric Power Board. Transformers. (B.X. 3379.)*

June 15th. 66,000-V oil circuit-breakers. (B.X. 3378.)*

LYTTELTON.—July 20th. Harbour Board. Four 5-ton electrically-operated portal cranes, and ten electrically-operated capstans. (A.X. 4532.)*

Oldham.—April 30th. Electricity Department. Coal-handling and conveyor plant. (April 15th.)

Plymouth.—April 25th. Electricity Department. Electricity meters, cables, and transformers. (April 1st.)

Prestwich.—County Mental Hospital.—Supply and fixing of electrical cooking apparatus, &c., at the annexe kitchen. (See this issue.)

South Africa.—JOHANNESBURG.—May 7th. Municipal Council. Electric street lamp fittings and globes. (B.X. 3395.)* Cables. (B.X. 3406.)*

May 12th. Transformers. (B.X. 3415.)*

CAPE TOWN.—June 1st. The University. Electric cooking utensils for the new residences at Groote Schuur. (B.X. 3393.)*

Southend-on-Sea.—April 28th. Light Railways and Electricity Department. 12 months' supply of lubricating oils. (See this issue.)

Stafford.—April 30th. Staffordshire Education Committee. Electric wiring and fittings for the new infants' department of the Slater Street Council school and in the additional class rooms, laboratory, &c., in the Salisbury Street central school. (April 8th.)

Uruguay.—MONTEVIDEO.—June 15th. State Electricity Supply Works. 15 transformer sub-station equipments (6,600/220 V, 50 cycles). (B.X. 3371.)*

Five overhead transformer sub-stations mounted on tubular or section iron columns. (B.X. 3430.)*

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

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Callender's Cable & Construction Co., Ltd.	718
British Insulated Cables, Ltd.	720

Bolton.—Electricity Committee. Accepted:—
Induced draught plant at power station.—Musgrave & Co., Ltd.

Tramways Committee. Accepted:—
500 tons of Sandberg steel tram rails.—Cargo Fleet Iron Co., Ltd.

Burton-on-Trent.—Electricity Committee. Accepted:—
Switchgear (£1,252).—Ferguson, Pailin, Ltd.

Croydon.—Electricity Committee. Accepted:—
Switchgear, Lower Coombe Street sub-station (£647), one feeder and two transformer panels for Thornton Heath (£473), and one feeder panel for Drovers Road (£167).—A. Reyrolle & Co.
Switchboard, &c., at Duro Rubber Co.'s sub-station (£107), 22 switch panels for extension of switchboards at various h.p. stations (£721).—Ferguson, Pailin, Ltd.
Four banks of 6,300-V, 3-phase, Scott-connected oil-cooled transformers, one 250-kVA ditto, and one 100-kVA ditto (£2,325).—British Electric Transformer Co., Ltd.
Boiler feed pump (£337).—Mather & Platt

Dumfries.—Town Council. Accepted:—
Battery booster (£434).—Lancashire Dynamo Co., Ltd.

East Ham.—Works Committee. Accepted:—
Automatic switches for electric lamps.—British Foreign and Colonial Automatic Light Controlling Co., Ltd., Tyer & Co., Ltd., and Acme Lighting Engineering Co.

Glasgow.—Tramways Committee. Recommended:—
Gear cases (steel).—W. C. Yuille & Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd.

Lamp Contracts.—Brentford, Holborn and Belfast Board of Guardians and the London, Midland & Scottish Railway have placed 12 months' contracts for Osram Lamps with the General Electric Co., Ltd. Belfast City Council has placed a 12 months' contract for Mazda electric lamps with the British Thomson-Houston Co., Ltd. The Port of London Authority has placed a six months' contract for Siemens lamps with the Siemens & English Electric Lamp Co., Ltd.

London.—GENERAL POST OFFICE.—Accepted:—
Rectifying valves.—Edison Swan Electric Co., Ltd.

SHOREDITCH.—Lighting Committee. Accepted:—
One 20-ton hand-operated crane (£199).—Vaughan Crane Co., Ltd.

SOUTHERN RAILWAY. Accepted:—
20 rotary convertors and 60 transformers in connection with the electrification scheme (approx. £120,000).—Allmanna Svenska Elektriska Aktiebolaget of Sweden.

Manchester.—Tramways Committee. Accepted:—
Assembled commutator segments for B.T.H. and B.W. armatures; armature coils for B.T.-H. and B.W. equipments.—Manchester Armature Repair Co., Ltd.
Tramway rail bonds.—Forest City Electric Co., Ltd.

Sheffield.—Electricity Committee. Accepted:—
12,000-volt switchgear at Blackburn Meadows (£3,811).—A. Reyrolle & Co., Ltd.
Erection of new chain grate stokers and accessories for boilers at Neepsend (£3,075).—Ed. Bennis & Co., Ltd.

South Shields.—Tramways Committee. Accepted:—
30 tons of tram rails (£295).—Cargo Fleet Iron Co., Ltd.
Three movable points (£258).—Malleable Steel Castings Co., Ltd.

Torquay.—Electricity Committee. Accepted:—
Two 72-inch screens in connection with new pump house at Newton Abbot (£1,720).—Brackett & Co.
Special Larner-Johnson valves for pumps (£256 per valve).—Blakeborough & Co.
Boiler house plant (£24,226).—Stirling Boiler Co., Ltd.
6,000-kW turbo-alternator, with condensing plant (£25,949, plus £242 for an extraction pump).—British Thomson-Houston Co., Ltd.

Wakefield.—Housing Committee. Accepted:—
Wiring 150 houses on the Snapethorpe Estate.—H. Smith.

Forthcoming Events.

Junior Institution of Engineers.—Tuesday, April 26th. Monico Restaurant. 6.30 p.m. Annual dinner.

Friday, April 29th. 39, Victoria Street, S.W. 7.30 p.m. "The Design and Balancing of 3-phase L.P. Distribution Systems." Mr. W. F. Cooper.

Birmingham Electric Club.—Friday, April 22nd. Grand Hotel. 7 p.m. "Radiation Effects." Mr. J. B. Kramer.

Association of Mining Electrical Engineers (North of England Branch). — Saturday, April 23rd. Durham. "Accumulators," Mr. A. W. Bridges. "Electrical Testing Gear for Collieries," Mr. H. J. Fisher.

Institution of Electrical Engineers (Mersey and North Wales (Liverpool) Centre).—Monday, April 25th. University, Liverpool. 7 p.m. Annual general meeting. Short papers by members.

(North-Eastern Centre).—Monday, April 25th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Annual general meeting.

(Scottish Centre).—Friday, April 29th. University College, Dundee.

(South-Midland Centre).—Wednesday, April 27th. University, Birmingham. 7 p.m. Kelvin lecture, "High-Frequency Currents." Prof. E. W. Marchant.

Royal Society.—Monday, April 25th. 8 p.m. Cantor Lecture. "The Measurement of Light." Mr. J. W. T. Walsh.

Illuminating Engineering Society.—Tuesday, April 26th. At 5.30 p.m. Visit to the Photometric Section of the National Physical Laboratory, Teddington. 7 p.m. "Work in the Photometry Department of the National Physical Laboratory." Mr. H. Buckley.

Batti-Wallahs' Society.—Tuesday, April 26th. Hotel Cecil. Luncheon. "How to Reconcile Relations Between the Consumer, the Producer, and the Wage-earner." Sir Arnold B. Gridley.

Institute of Wireless Technology.—Wednesday, April 27th. Engineers' Club. 7 p.m. "The Electrical Recording and Reproduction of Gramophone Records." Mr. H. J. King.

Royal Institution.—Friday, April 29th. 9 p.m. "Wireless Transmission and the Upper Atmosphere." Mr. E. V. Appleton.

Notes.

The International Electrotechnical Commission.

According to *Génie Civil*, the I.E.C. is to meet this year at Bellagio, on Lake Como, from September 5th to 12th, and at Rome on September 21st, for the final session. In the interval the members will visit Milan, Venice, Florence, and various hydro-electric works, under the ægis of the Italian Electrotechnical Committee. The sectional committees of the International Illumination Commission will meet at Bellagio from August 31st to September 3rd; many of its members belong to both Commissions, and will take part in the sessions and tour of the I.E.C.

The Electrical Trades Benevolent Institution.

The annual general meeting of this Institution will be held at the offices of the Institution of Electrical Engineers, London, on Thursday, April 28th, at 2.30 p.m.

Battery Traction in Belgium.

With M. L. Herry, director-general of the Centrales Electriques des Flandres, as chairman, there has been formed the Syndicat d'Etudes pour le Developpement de la Traction Electrique par Accumulateurs for the development of electric battery traction in Belgium. The chairmen of the various sections have been chosen as follows, says the *Electric Vehicle*:—Electricity supply: M. Lechien, president of the Union des Exploitations Electriques en Belgique; electrical materials: M. Rousseau, director-general of the Ateliers de Constructions Electriques de Charleroi; automobile: le Comte J. de Liedekerke, president of the Chambre Syndicate des Constructeurs d'Automobiles et de Cycles de Belgique; accumulator: J. Van de Wiele, of the Tudor Company. The secretary of the new Association (address: 158, Rue Royale, Brussels) recently visited England to study conditions and the activities of the British Electric Vehicle Committee.

Artificial Light Treatment for Children.

The Artificial Light Department at the Victoria Hospital for Sick Children, Tite Street, Chelsea, was formally opened recently. According to *The Times*, Dr. Murray Levick stated that from 50 to 60 treatments were being given *per diem;* nearly 4,000 treatments had been given since the department began work. The hospital had a special batch of cases suffering from tuberculous glands, and these were doing well. The results obtained up to the present justified the conclusion that children living in their own homes and coming for a prolonged course of this treatment three times a week progressed as well as those who were sent to expensive Alpine institutions.

Better Lighting.

In the course of a lecture recently delivered at Bedford Town Hall before a large audience, under the auspices of the Electrical Power Engineers' Association, on "Better Lighting for Shop and Home," Mr. R. H. Rawll, A.M.I.E.E., of the City of Birmingham Electricity Department, emphasised that the consumer should not merely consider the cost of electricity, but should also know how much light he was getting from it. Good lighting was a business investment, for the purpose of bringing in more business. Lighting shop windows after closing hours was effective advertising and could be done very cheaply.

B.E.S.A. Publication.

A recent publication of the British Engineering Standards Association is a B.S.S. for gear wheels and pinions for electric tramcars. One of the difficulties to be overcome in preparing the work was that although the dimensions were to some extent similar, each manufacturer worked to a slightly different formula for the tooth form, in addition to making use of many different materials and heat treatments for the manufacture of the wheels. It was recognised that with the advent of high-power motors and increased speeds on tramways it was essential not only to effect standardisation to provide interchangeability, but also to collect all the available knowledge of the materials used, and committees were formed, consisting of the makers of gears, representatives of the tramway undertakings, steel manufacturers and metallurgists, to go into the whole matter. Already a large number of gear wheels and pinions have been made to this specification, and it has been established that these are superior to those previously manufactured.

In addition to standard sizes and formulæ for tooth form, specifications of materials and heat are included for case-hardened forged gear wheels and pinions, case-hardened cast gear wheels, "45" carbon-steel forged gear wheels and pinions (water-hardened and tempered), and cast gear wheels (water hardened and tempered). There should therefore be no difficulty for tramway engineers to select the material best suited to their individual requirements and conditions of running. Copies of the specification (No. 235-1927) can be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d., post free.

Waste-Heat Recovery.

In a paper on "The Recovery and Utilisation of Heat from the Exhaust Gases of Internal-Combustion Marine Engines," read recently before the Institute of Marine Engineers by Mr. T. Clarkson, the thimble-type boiler is claimed to fulfil the ideal requirements of a waste-heat boiler. It was originally designed to meet the extremely stringent conditions met with in the problem of road transport, and the remarkable properties which it demonstrated in this service led to the suggestion that it should be used to deal with the waste gases from internal-combustion engines. It is claimed that, as the boiler tubes are secured at one end only, perfect freedom of expansion is obtained for each individual tube, and consequently no strain due to varying thermal expansion is imposed upon the tube joints. By spacing the thimble tubes closer together towards the outlet end, the effect of the gradual cooling down of the gases as they pass through the boiler can be easily compensated for. The author gives 300 deg. F. as the general practical limit beyond which the gases should not be cooled. One difficulty which is met with by designers of waste-heat boilers is the fact that there are no standard diameters of exhaust pipes in relation to horse power. It is always desirable to keep the exhaust pipe as small as possible, consistently with the avoidance of back pressure. Tests by Prof. Gilbert Cook have shown that an efficiency as high as 86 per cent. of heat recovery can be obtained.

Irish Free State Electricity Supply.

At a meeting of the General Committee of the Dublin Mercantile Association, Ltd., last week, a strong resolution was passed protesting against the action of the Irish Free State Government in promoting legislation which would deprive the ratepayers of Dublin, and consumers of electricity in Dublin and elsewhere, of the undertakings built up with their money and credit without adequate compensation, and calling on the Government and members of Dail Eireann to amend those provisions by providing equitable compensation for all property, public or private, taken over. The resolution added:—"That in the event of the Dail passing the Electricity (Supply) Bill, 1927, in its present form, we call on the members of the Senate to reject it."

A Small Hydro-Electric Plant.

With reference to the article under the above heading in our issue of April 1st, describing the hydro-electric scheme of the Northern Nigeria (Bauchi) Tin Mines, Ltd., it should have been stated that the information was derived from an article, "A.S.E.A. in Nigeria," by John F. Shipley, M.I.E.E., published in the A.S.E.A. *Journal*.

Educational.

The B.B.C. announces that the 24-page programme and syllabus of transmissions to schools is about to be issued for the period May to July. All stations are well provided with interesting material.

Market-Place Lighting.

The accompanying illustration depicts the system adopted by the Aylesbury electricity undertaking (engineer and manager: Mr. W. A. Turnbull, A.M.Inst.C.E.) for supplying electricity to about 30 stalls in the Market Place for lighting. Permanent sockets in the ground between the rows of stalls accommodate poles, from which are suspended C.T.C. cables. A 3-core cable supplies each row of poles, the connections

Overhead Cables, Aylesbury Market Place.

being made by means of plugs and sockets. Sockets, with fuses, are permanently fixed on each pole, and leads to the stalls are plugged in as required. The lighting is required on Saturdays, and one man does the whole of the work of erecting and dismantling the poles and wires in an 8½-hour day. A fixed charge per lamp is made to the stallholders, who are very pleased with the arrangement.

An Overspeed Test-House.

The Metropolitan-Vickers Electrical Co., Ltd., has built an overspeed test-house at its Trafford Park works which is designed to deal with two distinct classes of electrical machines, *viz.*:—(*a*) Low-speed waterwheel generators of large diameter and weight; (*b*) high-speed turbo-alternator rotors of great length and medium diameter and weight; whilst the apparatus provided is also suitable for testing turbine rotor disks and similar apparatus which, although of light weight, necessitates the use of very high speeds. The internal dimensions are large enough to take rotors up to 14 ft. 6 in. diameter, and shafts up to 40 ft. in length. The walls are 9 ft. 6 in. in thickness, and consist of an outer casing of reinforced concrete with internal air pockets, linings of bags of sand, and rafts of timber held in place by a light steel framework. Taking advantage of lessons learned during the war in the construction of shell-resisting structures, the composite walls are designed to take out the sting of impact by bringing the flying parts to rest gradually. In the construction of the building 800 cubic yards of concrete, 30 tons of steel, 2,000 cubic feet of timber, and 7,000 cubic feet of sand were used, exclusive of the moving door, which consists of ferro-concrete lined with wood, carried on spring-mounted wheels, and weighs 17 tons. Loads of 120 tons can be handled; two special bogies, mounted on a standard heavy-gauge railway track, are provided to carry the rotors to be tested. A 500-volt d.c. motor of 1,800 h.p. is mounted in a separate chamber, together with a gear box arranged to impart speeds of from 250 to 7,200 r.p.m. on the driven shaft; provision has also been made for obtaining speeds up to 21,600 r.p.m. The coupling shaft between the gear box and the rotor to be tested has been designed to sever in the case of any serious disturbance during a test, thus acting as a safety device to save the gear box from damage. The coupling used at the test-pit end is of the large-diaphragm type, which allows for slight misalignment and damps out the transmission of vibration. A high-pressure oil system provides for lifting the rotors on to an oil film to reduce the starting effort required, besides lubrication. In a separate cabin in the main shop complete control is centred, and data can be recorded under quiet and convenient conditions.

Australian Standard Voltages.

The Australian Commonwealth Engineering Standards Association has issued a tentative Australian standard for voltages and frequencies for new systems and installations. According to the *Electrical Engineer for Australia and New Zealand*, for d.c. systems the standard l.p. voltages are 460 and 230, and for a.c. systems the standards are 230 V between phase and neutral and 400 V between phases. The station voltages are in each case 10 per cent. higher. The h.p. delivered voltages are 2,000, 6,000, 10,000, 20,000, 30,000, 40,000, 60,000, 80,000, 100,000, and 120,000, with station voltages 10 per cent. higher. The 2,000-V pressure is only to be used in systems other than public supply systems and where special circumstances warrant the adoption of voltages lower than 6,000. The standard frequency is 50 cycles, provided that a frequency of 25 cycles may be used for special industries for which it has advantages. This specification is numbered C1 (*a* and *b*)—1926T. It is issued tentatively for a period of 12 months.

The Moscow Radio Station.

The newly-built "Great Komintern" radio broadcasting station in Moscow, Russia, for the construction of which Prof. Bonch Brouevitch was responsible, was recently officially opened. The plant is claimed to have a capacity of 40 kW, and the accompanying illustration is of interest inasmuch as it shows the unusual type of aerial mast that has been adopted. The station now under construction at Zeesen, near Berlin,

"Great Komintern" Aerial Mast.

in Germany, is credited with the possession of the tallest masts in Europe; they are of the rectangular lattice steel pattern, their height being 210 metres.

Rural Supply Deputation.

On April 13th a deputation of members of Parliament, introduced by Sir Douglas Newton, waited upon Sir Harry Haward at the offices of the Electricity Commissioners to express disappointment at the delay which is taking place in providing rural areas with electricity, particularly with regard to the difficulties met with in obtaining wayleaves. It was suggested that more power should be given to supply undertakings to deal with the "final objectors," who were not always the landowners, who often raised trivial objections, but sometimes the Post Office, the railway companies, and even other Government departments. It was pointed out that as much as £200 was often spent in obtaining a landowner's consent for a supply line to be run over his land. The high costs of erecting h.p. lines were also stressed, and it was asserted that these

varied from £1,200 to £1,300 per mile. The deputation also urged that more publicity should be given to the fact that it was not practicable to use buried cables for many of the transmission schemes. The inhabitants of rural areas did not realise that there was a real necessity for overhead lines, and also thought that such lines could be diverted to suit their own conveniences without serious consequences. It was suggested that a memorandum should be issued for the guidance of local authorities and the general public concerned, explaining the new legislation. This should contain a short concise statement of facts calculated to dissuade possible objectors from entering into unnecessary legal proceedings. It was proposed that it should be made clear that it would not be possible to tap the new "grid" at any point where any prospective consumer might want a supply. It was not generally realised that it would be necessary to provide subsidiary overhead systems for the various areas. The Commissioners were also urged to compile an approved schedule of reasonable pole rentals and to make it clear that no sanction could be given for excessive charges. The schedule should be prepared on the basis of the sizes of the poles, the necessary trenching of the cables, the different types of land and crossings, and the methods of erection employed.

Electrical Association for Women.

The second annual general meeting of the above Association will this year take the form of a two-days' conference in London on May 11th and 12th next. The first day's proceedings will include the business meeting and a luncheon at the Hotel Cecil. On the second day visits will be made to the works of Standard Telephones & Cables, Ltd., Woolwich, and to the Woolwich Housing Estate.

Manchester Steam Users' Association.

The memorandum by the chief engineer of the Manchester Steam Users' Association, Mr. C. E. Stromeyer, O.B.E., M.Inst.C.E., for the year 1926, has just been issued. It contains much valuable information concerning boiler failures, and many examples are given of curious cases taken from the Association's museum. Great importance is attached to corrosion, prominence being given to uniform wasting, the most misleading and dangerous form to be met with in boilers. Instances are illustrated of the substance of plates, seams, rivets and stays having been slowly eaten away while the original shape has remained to mislead the inexperienced. Instances of corrosion at the overlapping of boiler plates show that where corrosion has removed about two-thirds of the plate thickness, and an equal amount from the rivet heads, the corners of the lap have remained sharp, but the hollow corners of the lap and the rivet heads have experienced partial protection and become rounded, a distinctive feature of this form of corrosion. It appears that sulphur dioxide does not attack cold steel, but when part of a furnace becomes overheated, due to scale or deposit, the metal is readily attacked by the gas.

An instance is quoted of a furnace ring collapsing as a result of uniform wasting. The cause was never revealed, but it is suggested that had the possibility of the trouble being brought about by thermo-electric currents presented itself at the time, the cause might have been found. It is shown that if a circuit can be established from one side of the plate, through the water and another part of the boiler and back to the starting point, weak but uniform corrosion is likely to occur.

A case of corrosion of the sides of a Lancashire boiler furnace, where the crossbar supporting the brick bridge was resting on the furnace sides, and not on angle brackets, supports the view that some forms of corrosion are due to certain strains having the power of making steel susceptible to corrosion attack.

It is recommended that cast-iron feed pipes and valves should not be fitted to boilers, as cast-iron is liable to graphitic corrosion. Referring to the corrosion found on the plates of the steam spaces of boilers, it is pointed out that now that the discovery has been made that steel creeps if overheated, the possibility of this form of corrosion being associated with creep or heat-straining should not be overlooked. The prevalence of incrustation in economiser pipes is evidenced by some illustrated examples. In one case the pipe shows a crack which occurred after removal, due to the swelling of the scale. A curious furnace-tube fracture of a l.p. boiler is illustrated. An internal bulge was created, and the scale on the tube exterior remained intact, being sufficiently porous to allow the steam to pass through it. Some useful data are given concerning steel failures with varying nitrogen and phosphorus contents, and where caustic soda had been introduced. Considerable information is also given with regard to the study of fatigue phenomena. Something of the early research work of the Association is also given, including descriptions of some of the early instruments employed.

Appointments Vacant.

Travelling meter engineer for the Electrical Apparatus Co., Ltd. Plumber-jointers for the Prestatyn U.D.C. Electricity Department. Meter mechanic (69s.) for the Darwen Corporation Electricity Department. Charge engineer for Doncaster County Borough Electricity Department. Assistant mains engineer (£366) for the Walthamstow U.D.C. Electricity Department. (See our advertisement pages to-day.)

Institution Notes.

Institution of Electrical Engineers.

Scottish Students' Section.—The following office bearers for the 1927-28 session have been appointed:—*Chairman*: Mr. J. Eccles; *Vice-Chairman*: Mr. A. Calder; *Hon. Secretary*: Mr. J. G. Boyne; *Members of Committee*: Messrs. J. A. Butters, T. Donaldson, A. Moir, and M. G. Say. The two remaining members of committee, one representative each from Glasgow University and the Royal Technical College, will be elected at the commencement of next session.

Junior Institution of Engineers.

At a meeting of the above Institution, on April 8th, a lecture and demonstration was given by Mr. E. Ambrose, M.I.E.E., on the subject of "Electrical Osmosis." The lecturer said that osmosis was closely related with dialysis and might be defined as "the tendency of fluids to mix or become equally diffused when in contact, even through an intervening membrane or porous structure." If a diaphragm were placed in a cell so as to divide it into two portions, each portion containing, say, acidulated water, and a current of electricity were passed through the diaphragm, then the liquid in one side of the cell would increase, showing that the water passed through the diaphragm. The phenomenon was electrical osmosis. Mr. Ambrose said that electrical osmosis was ever present in connection with rubber and fabric insulated conductors that were carrying d.c., any moisture being driven through to the copper of the negative. The dewatering of substances by electrical osmosis had been tried to a large extent in Germany. There was also a process for extracting sugar from beet, and for dewatering and purifying clays. There seemed to be much scope for the use of electro-osmotic action, as it had been demonstrated that liquids bearing narcotics or drugs could be forced through living skin and membrane by an electric current.

Iron and Steel Institute.

The annual meeting of the Institute is to be held this year on May 5th and 6th, at the Institution of Civil Engineers, when a large number of papers will be read. The annual dinner will be held at the Connaught Rooms, Great Queen Street, on May 5th. The autumn meeting will be held at Glasgow on September 20th to 23rd, at the invitation of the West of Scotland Iron and Steel Institute.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Torquay Corporation has appointed Mr. T. W. Mackay, B.Sc., A.M.I.E.E., construction superintendent to Messrs. Balfour, Beatty & Co., Ltd., for the Llanelly district, to the position of distribution engineer.

The Hastings Town Council has appointed Mr. C. Barratt, of Bradford, as salesman at the electrical showrooms at a commencing salary of £200 a year. There were 171 applications.

Upon the completion of the reconstruction of a large section of the Newcastle-Carlisle main road recently, Mr. A. C. Rayment, A.M.I.E.E., was presented by the men engaged upon the work with a case of pipes, a pouch, and an illuminated testimonial.

Mr. Henry Adam, electrical engineer and manager to Annfield Plain Urban District Council for the past seven years, has been appointed clerk of works and subsequent resident electrical engineer in connection with the Seaham Harbour electricity scheme.

Mr. Breadmore, inspector on the staff of the Reading Corporation Tramways, has retired after nearly 50 years' service with the undertaking.

On accepting an important appointment on the engineering staff of the Central Electricity Board, Mr. C. W. Marshall, M.I.E.E., has resigned the position of chief technical assistant in the Glasgow Corporation Electricity Department. Mr. Marshall joined the staff of the Department over 14 years ago, and has held the position of chief technical assistant since 1916. He has made a special study of the most modern methods of generation, transmission, and distribution of electrical energy over wide areas, both in this country and on the Continent. In addition to articles contributed to our pages, books from his pen have been published dealing with the modern generating stations, protective gear, and electric battery vehicles. Mr. Marshall takes up his new appointment early in May

The Rev. L. VAN VESTRAUT, M.A., who has for several years been chief assistant in the Testing Department at Faraday House Electrical Engineering College, has been appointed registrar. Mr. F. A. BELL, F.C.A., has been appointed secretary.

Mr. C. R. WESTLAKE, of the Yorkshire Electric Power Co., has been appointed district mains engineer to the Bedford Corporation Electricity Department.

Mr. JOHN PENDREICH has resigned his position with Messrs. Wood & Cairns, Ltd., Edinburgh, and has started as a manufacturers' agent at 73, Saughtonhall Drive, Edinburgh.

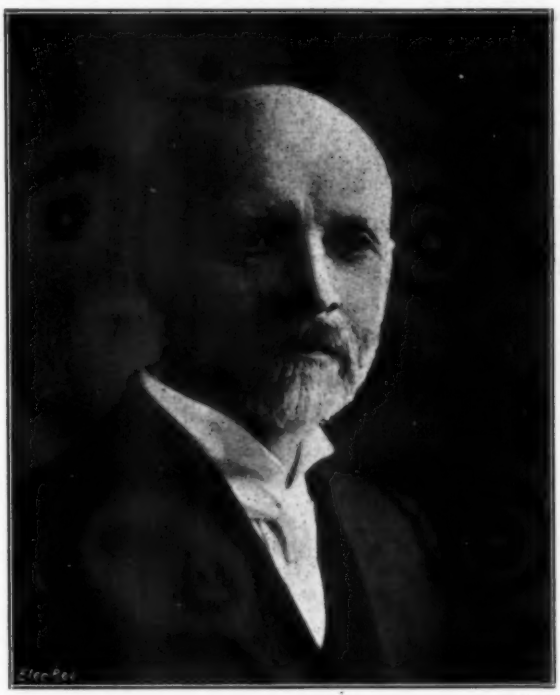
Obituary.—LT.-COL. PATRICK WALTER D'ALTON.—We regret to announce that on April 10th Lieut.-Col. P. W. d'Alton died at Westcliff, aged 71. Col. d'Alton, who was a member of the Civil, Mechanical, and Electrical Engineering Institutions, was educated at Dublin University and King's College, London, and first tried his hand at civil engineering, but speedily turned to the mechanical branch, and served his pupilage at the Reading Ironworks. After further experience gained at the North-Eastern Marine Engineering Works and Messrs. R. & W. Hawthorn's Works, he went to sea and eventually acquired the Board of Trade's certificate as chief engineer. In 1886 he became chief engineer to the Nordenfeldt Submarine Boat Company, but in 1889 he entered the electrical industry, as resident engineer in the Deptford power station of the London Electric Supply Corporation, and two years later he succeeded Mr. Ferranti as engineer-in-chief. During the South African war he served as major in the 6th Battalion, Royal Irish Rifles; afterwards he was appointed chief engineer to the Central London Railway, and from 1903 to 1914 he was chief mechanical engineer to Messrs. Dick, Kerr & Co., Ltd., in which capacity he carried out the conversion of the Liverpool-Southport Railway to electrical operation, and visited various parts of the world.

He took up private practice in 1914, but was chief engineer to the Valuation Committee from 1916 to 1921, with the rank of lieut.-colonel, and was responsible for advising the Ministry of Munitions and the Board of Inland Revenue on commercial questions arising out of the war. Afterwards he resumed his private practice. A man of striking personality, he was immensely popular, and was widely known in the engineering world, in which his undoubted ability made him an outstanding figure.

MR. M. MACLEOD.—The death took place at Rawmarsh on April 8th of Mr. Murdo MacLeod, who for 20 years had been traffic superintendent of the Mexborough and Swinton Tramways Co.

CAPT. REGINALD JOHN WALLIS-JONES.—On April 16th Capt. R. J. Wallis-Jones died, after a long illness; particulars of his career will be given in our next issue.

MR. ALBERT GAY.—We have to record with regret the death, after a protracted illness, of Mr. Albert Gay, consulting and resident electrical engineer to the Islington Borough Council, at his home, on Tuesday, April 12th, at the age of 68 years. Mr. Gay was a native of Barnstaple, and entered the electrical field at the Lambeth works of the Anglo-American Brush Electric Light Company; in 1881 he joined Hammond & Co. as installation engineer, but from 1884 to 1887 he was in business on his own account. Subsequently Mr. Gay acted as chief engineer to the Eastbourne, Brighton, and House-to-House Companies in turn, before, in 1894, he was commissioned by the Islington Vestry to design and construct electricity works for the parish and to take charge of the undertaking; in that capacity he continued, under the Borough Council, until his death—a period of nearly 33 years. Mr. Gay was a member of the Institution of Electrical Engineers, and a past-president of the Associated Municipal Electrical Engineers; in conjunction with Mr. C. H. Yeaman he wrote a book, "Central Station Electricity Supply," which for many years had the field to itself, and he took an active part in literary and technical work. One of the pioneers of electricity supply in London, he was latterly a redoubtable opponent of the policy of the Electricity Commissioners with regard to the closing of the older and less efficient municipal generating stations.



Elliott & Fry] **The late Mr. Albert Gay.** *[London.*

Will.—Mr. STEWART M. BANKER, late superintending electrical engineer, G.P.O., left £3,167 gross and £1,094 net personalty.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Siderman Electrical Supplies, Ltd.—Private company. Registered April 9th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers, importers and exporters of and wholesale and retail dealers in electric lamps, electrical accessories, electric cables, &c. The first directors are:—A. Siderman, 51, Cleveland Street, Fitzroy Square, W., electrical factor; N. A. L. Stilling, 25a, Westbourne Terrace, Bayswater, W. Qualification, 10 shares. Solicitors: Hugh M. Everard & Co., 28, Maddox Street, W. Registered office: Goodwyn House, 4, Fitzroy Square, W.

Electric Agencies, Ltd.—Private company. Registered April 14th. Capital, £2,000 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in automobiles, motor-cars, cycles, bicycles, aeroplanes, dynamos, accumulators, lamps, machinery, &c. The subscribers are:—S. F. Parish, 12, University Place, Cardiff, sales manager; L. J. Victor, 53, Grosvenor Street, Cardiff, builder. The first directors are to be appointed by the subscribers. Qualification, 100 shares. Secretary: I. G. Smalldridge. Registered office: 45, Caroline Street, Cardiff.

R.I. and Varley, Ltd.—Private company. Registered April 14th. Capital, £500 in 1s. shares. Objects: To carry on the business of selling agents for wireless, electrical, mechanical and other instruments, &c. The directors are:—J. Joseph, 12, Hyde Street, W.C.1; J. M. G. Rees, Cambridge Place, Burrage Road, Woolwich, S.E.18. Solicitors: Garton & Co., 21, Maddox Street, W.

Elektromekano Co. (London), Ltd.—Private company. Registered April 13th. Capital, £100 in 1s. shares. Objects: To carry on business as merchants and agents for the sale of all types of electrical machinery, apparatus and accessories, &c. The directors are:—K. A. Malmberg, 48, Copers Cope Road, Beckenham; S. G. Clarke, 59, Lavender Vale, Wallington, merchants' manager (both directors of K. Malmberg, Ltd.). Qualification, £1. Secretary: S. G. Clarke. Solicitors: Keene & Co., 15, Seething Lane, E.C.3. Registered office: 110, Cannon Street, E.C.4.

Power Lines Construction Co., Ltd.—Private company. Registered April 11th. Capital, £10,000 in £1 shares. Objects: To carry on the business of constructors of and dealers in cables, wires, lines, stations, accumulators, lamps, meters, works and engines for the purposes of supplying electricity for motive power, light, heat, &c. The first directors are:—H. H. E. Wood, 27, Onslow Avenue Mansions, Richmond, Surrey; C. W. Bloomfield, 6, Stanhope Court, Stanhope Place, W. Secretary: H. H. E. Wood. Solicitors: Frank Simmonds & Carter, 98, Salisbury House, E.C.2. Registered office: Palace House, Bridge Street, S.W.1.

N.S. Accumulators, Ltd.—Private company. Registered April 13th. Capital, £6,000 in £1 shares. Objects: To acquire the business of manufacturers of N.S. accumulators now carried on as "Bulley & Forbes," at 30, Lomond Grove, Camberwell, by W. R. V. Forbes and T. J. Bulley. The permanent directors are:—W. R. V. Forbes (chairman), Victoria Mansions, 28, Victoria Street, S.W.1; T. J. Bulley, 201, Devonshire Road, Honor Oak Park, S.E.23; G. A. Houghton, 49, Blessington Road, Lewisham, S.E.13. Qualification, £100 shares. Solicitors: Sir Henry C. Eggar, 164, Winchester House, E.C. Registered office: 30, Lomond Grove, Camberwell, S.E.5.

C.C.A. (Vacuum Cleaners), Ltd.—Private company. Registered April 13th. Capital, £3,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners, electrical implements, appliances, installations, labour-saving devices, machinery, and hardware of all kinds, &c. The subscribers (each with one share) are:—A. W. Rowoldt, 83, Queen Street, E.C.4, merchant; P. Hayter, 83, Queen Street, E.C.4, merchant; T. A. Blow, 83, Queen Street, E.C.4, cashier. The first directors are to be appointed by the subscribers. Qualification, one share. Solicitors: Cruesemann & Rouse, 40-42, King William Street, E.C.4.

Official Returns of Electrical Companies.

Goswell Engineering Co., Ltd.—R. G. Pye, C.A., of 6, Martin Lane, E.C., was appointed receiver on March 29th, 1927, under powers contained in debenture dated July 14th, 1926.

Thermionics, Ltd. (formerly G. W. I. Valves, Ltd.).—Capital, £150 in 1s. shares. Return dated December 31st, 1926 (filed February 9th, 1927). All shares taken up. £150 paid. Mortgages and charges, £1,000. L. A. Bartlett, of 639, Salisbury House, E.C.2, was appointed receiver and manager on July 16th, 1925, and was still acting as such on January 15th, 1927.

Trent Electric Wire Works, Ltd.—Capital, £2,500 in £1 shares. Return dated December 31st, 1926. All shares taken up. £1,500 paid. £1,000 considered as paid. Mortgages and charges, £1,000.

British Radio Corporation, Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated February 28th, 1927. 870 ordinary shares taken up. £650 paid. £220 considered as paid. Mortgages and charges, nil.

Yorkshire Electric Transformer Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1926 (filed March 21st, 1927). 3,530 shares taken up. £3,530 paid. Mortgages and charges, nil.

Galliers (Wholesale), Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926 (filed March 25th, 1927). 100 shares taken up. £1 per share called up on each. £100 unpaid. Mortgages and charges, nil.

William J. Hook & Co., Ltd.—Capital, £1,000 in 500 preference and 500 ordinary shares of £1 each. Return dated December 16th, 1926. 400 preference and 3 ordinary shares taken up. £403 paid. Mortgages and charges, nil.

Morris Electrical Co., Ltd.—Capital, £1,000 in 400 preference and 600 ordinary shares of £1 each. Return dated December 31st, 1926 (filed January 29th, 1927). 25 preference and 402 ordinary shares taken up. £177 paid. £250 considered as paid. Mortgages and charges, £200.

G. L. Electrical Supply Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1926. All shares taken up. Nil called up on 2 shares. £998 considered as paid. Mortgages and charges, nil.

Unity Lamp and Accessories, Ltd.—Capital, £2,000 in £1 shares. Return dated May 25th (filed December 10th), 1926. 1,900 shares taken up. £1,187 10s. paid (being 12s. 6d. per share on each). Mortgages and charges, nil.

C. F. Palmer (London), Ltd.—Land Registration charge on 63a, Effra Road, and land in rear of 63-5-7, Effra Road, Brixton, dated March 28th, 1927, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Woking Electric Supply Co., Ltd.—Issue on March 3rd, 1927, of £700 debentures, part of a series already registered.

Electric Construction Co., Ltd.—Satisfaction to the further extent of £4,740 on March 31st, 1927, of 4 per cent. perpetual first mortgage debenture stock secured by trust deed dated December 16th, 1897, securing £200,000.

Plessey Co., Ltd.—Debenture charged on property in Vicarage Lane, Ilford, and the company's undertaking and property, present and future, including uncalled capital, dated March 16th, 1927, to secure all moneys due or to become due from the company to Lloyd's Bank, Ltd.

Howarth, Green & Co., Ltd.—Particulars filed of £2,000 debentures authorised March 25th, 1927, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Bromley (Kent) Electric Light and Power Co., Ltd.—Satisfaction in full on or before March 15th, 1927, of debenture stock dated July 7th, 1902, and June 6th, 1904, securing £70,000.

J. Marse & Co., Ltd.—C. W. J. Mason, of 41, Finsbury Square, E.C.2, ceased to act as receiver or manager on March 5th, 1927.

C. F. Elwell, Ltd.—A. White, of 34, Norfolk Street, W.C.2, was appointed receiver on April 1st, 1927, under powers contained in debentures dated June 3rd and 30th, and October 29th, 1921.

Geoffrey Boulding, Ltd.—E. C. Williams, of 107a, Mortimer Street, Herne Bay, was appointed receiver and manager on March 23rd, 1927, under powers contained in debenture dated March 29th, 1926.

City Notes.

Montevideo Telephone Co., Ltd.

It was recently reported that an offer of £2 for each of this company's shares had been made, but no mention was made of the source of the offer. The *Financial Times* now reveals that the prospective purchaser is the International Telephone and Telegraph Corporation of New York. This concern, which has a total capital of over sixty million dollars, has a number of interests in America and Europe, including Standard Telephones & Cables, Ltd. In 1925 it acquired an agreement with the Uruguayan Government for the construction of an underground telephone system in Montevideo at a cost of about $5,500,000. The completion of this system would give the Government a monopoly of the city's telephone business. Apparently the Government is unable to find the money, and our contemporary infers that the purchase by the New York concern of the Montevideo Telephone Co.'s business is due to an apprehension that the latter might secure a fresh concession. It is pointed out that the installation of modern plant will involve an expenditure of about £2,000,000. The *Financial Times* believes that the majority of the shareholders have already accepted the offer. It is announced that Mr. J. G. le Marchant has resigned from the board, and that his place has been taken by Mr. H. M. Pease.

South Wales Electrical Power Distribution Co.

The directors of this (Parliamentary) company announce that, in spite of the adverse conditions of the past year, there was a gross profit of £89,069 for the last year. After meeting the debenture interest and preference dividend, it is proposed to transfer the balance (£18,743) to the depreciation reserve, making £149,858. The South Wales Power Co., Ltd., reports a total income from the Distribution Company's and other securities of £59,362, to which is added £8,441 brought forward, making £67,803. After meeting debenture interest, preference dividend, &c., there remains a balance of £10,990, which is to be carried forward. The report states that conditions during the year prevented the company from reaping the benefit which would have accrued from the full use of the new plant. An extraordinary meeting is to be held on April 26th for the purpose of considering resolutions raising the Power Company's capital by £250,000 to £1,100,000.

Northern General Transport Co., Ltd.

The net revenue for the year was £75,620, and after providing for loan and debenture interest, renewals, &c., there remains £34,099, to which is added £7,112 brought forward, making £41,211. The dividend on the ordinary shares is 7 per cent. (of which 2½ per cent. has already been paid), and £2,440 is carried forward. During the year £51,101 was spent on capital account. The nominal values of the company's investments at December 31st last were as follows:—Gateshead and District Tramways Co., £278,410; Tynemouth and District Electric Traction Co., Ltd., £58,205; and Jarrow and District Electric Traction Co., Ltd., £59,598. These stand at a cost of £420,141. In May last an issue of 118,750 £1 ordinary shares was made at par. The meeting was to be held yesterday (Thursday).

Brompton and Kensington Electricity Supply Co., Ltd.

The report for 1926 states that since January 1st of that year the company has purchased its electricity from the London Power Co., Ltd., to which the generating station has been leased. During the year £58,466 of the reserves was capitalised and distributed as ordinary shares to existing holders of ordinary shares in the ratio of one new share for each five held. The amount of energy sold rose from 6,553,067 kWh to 6,867,875 kWh. After providing the statutory amounts for the sinking and contingency funds the net revenue is £50,288, and after paying the preference and standard ordinary dividends, a balance of £19,496 is carried forward. Meeting: April 28th.

Rhondda Tramways Co., Ltd.

The accounts for the past year show a net loss of £19,148, after providing for an operating loss of £4,924, interest, rent, &c. From this is deducted a balance of £4,283 brought forward, leaving a deficit of £14,866 to be carried to the next account. The district served is purely a mining one, and business was naturally seriously affected by the coal dispute and general strike. Since the end of the dispute receipts have been gradually improving, but some time will elapse before normality is reached. The report states that the engineer and manager, Mr. Holliday, died in June last; Mr. T. G. Richardson, late general manager of the Hartlepool Tramways, has been appointed to the position.

Western Union Telegraph Co.

The income account for 1926 shows a gross operating revenue of $134,464,886, and a balance transferred to surplus account of $15,205,049. The latter account shows a total surplus of $80,173,160, from which are deducted adjustment of surplus (net) $788,417 and dividends $7,980,700, leaving a surplus at December 31st of $71,404,042. During the year the company's authorised capital was increased from $100 to $105 millions, and an increase of $25 millions in the bonded indebtedness was authorised. At the end of the year the system comprised 213,637 miles of pole lines; 3,324 miles of landline cables; 28,821 nautical miles of ocean cables; and 24,688 telegraph offices.

Bombay Electric Supply and Tramways Co., Ltd.

The report for 1926 shows that the total revenue for the year was Rs.150 lakhs and the total expenditure Rs.80 lakhs, leaving a gross surplus of Rs.70 lakhs. After deducting depreciation, interest, &c., there remains a net profit of Rs.48 lakhs for distribution as dividends. Dividends of 7 per cent. on the cumulative preference shares and 14 per cent. on the ordinary shares have been declared. The company has decided to open at its head office in Bombay a showroom where the best means of utilising electricity for lighting, power, and cooking will be demonstrated.

Canadian General Electric Co.

After providing for reserves, taxation, and depreciation, the net profit for 1926 is $1,170,618, as compared with $933,751 in 1925. There are no loans or debentures; the preference dividend (7 per cent.) absorbed $599,042. A great amount of obsolete equipment has been written off, requiring the whole of the depreciation reserves and utilising part of the year's balance. The outlook for the current year is said to be good, both in the heavy machinery and small supplies departments.

Electric Supply Corporation, Ltd.

The gross earnings for 1926 were £103,966 and the net profit was £42,357 (against £46,977). The ordinary dividend and bonus is maintained at 11 per cent., £3,000 is transferred to general reserve, and £10,110 to depreciation fund, £1,000 is written off underwriting commission on preference share issue, and a balance of £5,101 is carried forward. At the meeting on April 25th a resolution providing for the raising of the capital from £350,000 to £500,000 will be submitted.

Foundation Co., Ltd.

Last week this company issued, for information only, particulars of £150,000 of 6½ per cent. secured bearer notes redeemable at par on December 31st, 1929, the issue of which was sanctioned on April 11th. The notes will be secured as a floating charge on the undertaking and property of the company present and future, and the proceeds will be utilised for meeting capital expenditure incurred in the general expansion of the business.

Direct Spanish Telegraph Co., Ltd.

The balance of profit for the past year, including £1,213 brought forward, was £10,366. After paying the preference dividend and one of 10 per cent., free of tax, on the ordinary shares, £900 remains to be carried forward. The traffic receipts show a decrease of £446 as compared with the previous year. The company's cables worked without interruption during 1926. Meeting: May 3rd.

Electrical Distribution of Yorkshire, Ltd.

The directors announce that the issue of 300,000 £1 ordinary shares to existing shareholders in proportion to their holdings has been very successful. The applications for additional shares (apparently those not taken up by shareholders) represent double the amount available.

Wycombe (Borough) Electric Light and Power Co., Ltd.

After providing for all expenses, including debenture interest, preference dividends, &c., and crediting the balance brought forward, the net profit for 1926 was £13,222. An interim ordinary dividend of 4 per cent., free of tax, was paid, and it is proposed to distribute a further 6 per cent., free of tax, to transfer £4,000 to general reserve, and £500 to superannuation provision account, leaving £1,222 to be carried forward. To meet the increasing demand, additional generating plant, cables, &c., have been installed, and since the end of the year 3,000 ordinary shares have been issued. The original plant has been removed. Mr. F. E. Gripper has resigned the position of chairman through ill-health, and his place has been taken by Mr. A. N. Rye, while Mr. C. H. Jones has been elected a director.

Madras Electric Tramways (1904), Ltd.

The gross profit for the past year was £21,628 and the net profit £5,650 (against £14,392). To this is added £7,516 brought forward, making £13,166. The preference dividends are paid, and a balance of £7,166 is carried forward. For 1925 the ordinary dividend was 6 per cent. The decline in the profit is attributed to competition.

Chelsea Electricity Supply Co., Ltd.

The directors' report for the past year records a net profit of £41,997, after providing for debenture interest and the statutory amounts for the sinking and contingency funds. The preference and standard ordinary dividends are paid, and a balance of £5,097 is carried forward. The connected load rose from 12,159 kW to 12,747 kW, and the sales of energy from 7,092,550 kWh to 7,746,878 kWh. The meeting is to be held on April 28th.

The Great Northern Telegraph Co., Ltd., of Denmark.

The directors propose to distribute a total dividend and bonus of 20 per cent., including the 5 per cent. already paid, for the year 1926, and to transfer £20,000 to the reserve and renewal fund, while £37,500 has been allotted to the pension fund. £192,624 is carried forward.

Anglo-American Telegraph Co., Ltd.

A dividend of 15s. per cent. has been declared on the ordinary stock and one of £1 10s. per cent. on the preferred stock for the quarter ended March 31st. The rates are the same as a year ago.

Lisbon Electric Tramways Co., Ltd.

The balance of arrears of preference dividend is being paid and at the same time an interim dividend of 3 per cent. net has been declared on the ordinary shares. The last payment of ordinary dividend was 4½ per cent. in respect of 1915.

Simms Motor Units, Ltd.

Out of a net profit of £30,565 for 1926 the company is paying a dividend of 12½ per cent. (against 10 per cent.), of which 4½ per cent. has been paid, transferring £10,000 to reserve (against *nil* last year), and carrying forward £33,173.

Dutch Company.

The Amsterdam correspondent of the *Financial Times* reports that the *Netherlands Cable Factories* has declared a dividend of 24 per cent. for 1926, as against 21 per cent. for the previous year.

Herbert Morris, Ltd.

A dividend at the rate of 7½ per cent. per annum has been declared on the ordinary shares for the six months ended January 31st last.

Marconi International Marine Communication Co., Ltd.

The directors recommend a final dividend of 5 per cent., making 8¾ per cent. for the year, as against 7½ per cent. for 1925.

Joseph Lucas, Ltd.

An interim dividend of 5 per cent. has been declared on the ordinary shares.

Erinoid, Ltd.

It is proposed to pay an interim dividend of 3 per cent., as compared with 4 per cent. last year.

Brazilian Traction, Light and Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been declared on the ordinary stock, as against 1¼ per cent. last year.

Stocks and Shares.

TUESDAY EVENING.

EASTER holidays and the Budget being comfortably out of the way, Stock Exchange markets have no valid excuse, save that of China, for being otherwise than animated and cheerful. The Budget, so far from being a drag upon prices, a bull point. No increase in income-tax, no raid upon the Sinking Fund, no oppressive taxes upon industry—these are

three negative consolations of active interest. They make for confidence amongst investors. They encourage a feeling of hopefulness in regard to the trade outlook: a general rise in iron and steel shares is testimony to the cheery prospect which speculators consider to open in front of the heavy trades of the country.

Babcock & Wilcox rose another 1/16th to 55s. on the figures in the report, which is considered very satisfactory in view of the trade conditions that prevailed during the period covered by the accounts. There is a greater disposition, shown in various directions, to regard with favour the shares in manufacturing companies. Siemens, for example, are better than the nominal price suggests, there being buyers about at the middle figure. British Aluminium ordinary regained the 9d. lost in the previous week. A fall of 10s. in Telegraph Constructions draws attention to the low yield afforded by the shares. The only reason why proprietors accept so slender a return is the hope of the Board declaring a bonus, which hope has buoyed the price for years past, but which seems as far off as ever from fulfilment.

Eastern Extensions are ¼ up at 17½, this being the only change in their group. Marconis are fluctuating between 17s. 6d. and 18s. Although the opposition to the reorganisation plan is stilled for the time being, the objectors are but waiting for the resolutions to come before the Court, when the protests are to be raised again. In the Stock Exchange the assumption is general that the scheme will go through, and that the capital reduction, &c., will be duly carried out. Burndept preferred are flat at half-a-crown.

Reference was made here three weeks ago to the statement on the subject of Beam developments by the president of the important American concern known as Mackay Companies. In that statement, naturally, not wholly unbiased, he defined the Beam radio as a system using low power and short waves which, by means of suitable reflectors, are more or less concentrated into a converging beam directed towards the receiving apparatus. The older trans-ocean wireless systems use high power and long waves which are much less susceptible to efficient directional sending. The superiority of short waves over long waves, he declared, remains to be proved, and he quoted Dr. W. H. Eccles, president of the Institution of Electrical Engineers, as saying that a commercial (radio) firm competing with cables would find long waves generally more trustworthy. The development of the high inductance, or so-called "loaded" cable, is a long forward step; general progress and improvement in recent years have been marked and important, even if lacking in spectacular appeal. A good deal is made, of course, of the ease with which "beam" radio can be picked up by anyone possessing the necessary equipment.

Technical testimony to the composure with which radio and wireless achievements can be regarded by holders of cable securities is of solid value. A dozen times during the past 25 years scares of greater or of less intensity have disturbed the cable companies' proprietors. Yet, in spite of the wonderful advance made by the newer systems, and the marvels which these can now accomplish, nothing has so far arisen to shake the so oft-repeated conviction that there is plenty of room for them all; that one is complementary, rather than antagonistic to the other, and that the Senior Service keeps abreast of modern requirements by linking wireless interests to those of the submarine cable. Marconi Marine proposes a dividend making 8¾ per cent. for last year, against 7½ per cent. for 1925.

Automatic Telephones remain dull, but Internationals rallied a trifle to 41s. 9d., and the deferred to 40s. 9d. Telephone Manufacturing are 7s. 3d.

Mexican Light and Power preferred are conspicuous with a rise of 7½ points, at 107, on the assumption that the scheme for dealing with dividend arrears stands upon the point of publication. According to market talk, the details of the plan are settled, but require one formal assent before the plan can be placed in front of the proprietors. Other Mexican issues are unchanged. Brazilian Tractions have gained 1½ points. The Anglo-Argentine Tramways group is steady. British Columbia Electric Railway preferred has put on 1, at 116½. The London railway and tramway descriptions are quiet, Underground £1 shares being 6d. up, at 16s. 6d., on the expectation that bumper traffics were secured at Easter.

Electric Supply shares are uninteresting, a decline to 59s. 6d. in Bournemouth and Poole being offset by a slight improvement in Metropolitan ordinary shares. Hope deferred possibly maketh sick the hearts of speculative investors who bought Bournemouth and Poole shares many months ago, believing that the company would be acquired by one of the corporations—Bournemouth being the more obvious. Alternatively, it was hinted that the company might make some kind of a bonus issue to its shareholders. But nothing more than gossip has resulted from these rumours.

India Rubber shares are a harder market at 20s. The readier disposition on the part of the public to buy iron and steel shares has already been noted. Rubber, as regards shares and produce, is tame, offering no interest or excitement. Business generally in the Stock Exchange is of the retail order. It is expected, and with good reason, that the Bank rate will be reduced in the near future. This, with the cheery effect produced by the Budget, is responsible for a strong tone in most of those Stock Exchange departments that look for their price-movements to the inspiration of money market considerations.

Share List of Electrical Companies.

	Nom.	Dividend. 1925.	Dividend. 1926.	Price Apr. 19 1927.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14	14	59/6	—½	4 14 1
Brompton Ordinary	1	10	8¾	25/6	—	7 5 3
Charing Cross Ordinary	1	15	8½	25/-	—	5 12 0
do. do. 4½ Pref.	1	4½	4½	17/-	—	5 6 0
Chelsea	1	12	8¾	25/-	—	5 12 0
City of London	1	15	10	1[illegible]	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Clyde Valley	1	8	8	31/-	—	5 3 3
County of London	1	15	7½	27/6	—	5 1 10
do. do. 6% Pref.	1	6	6	22/6	—	5 6 8
Edmundson's Ordinary	1	7	8	26/3	—	6 2 0
do. 7% Pref.	1	6	7	23/-	—	6 1 9
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	1	15	8	25/-	—	5 12 0
Lancs. Light and Power	1	7½	7½	26/-	—	5 15 5
London Electric	1	10	8½	24/-	—	5 16 8
do. do. 6% Pref.	5	6	6	5[illegible]	—	5 10 4
Metropolitan	1	11	5	26/6	+6d.	4 18 3
do. 4½% Pref.	1	4½	4½	17/-	—	5 2 10
Midland Counties	1	5½	6	22/6	—	5 6 8
Newcastle-on-Tyne Ordinary	1	7	5	22/6	—	4 9 0
do. 5% Pref.	1	5	5	17/6	—	5 14 3
do. 7% Pref.	1	7	7	24/-	—	5 16 8
Notting Hill 6% Pref.	10	6	—	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/-	—	5 9 1
St. James' and Pall Mall	5	17½	8	25/6	—	5 9 10
South London	1	15	8½	25/-	—	5 12 0
South Metropolitan Pref.	1	7	7	1[illegible]	—	6 3 0
Urban Ordinary	1	4	7	25/6	—	5 9 10
do. 6% Pref.	1	6	6	1[illegible]	—	5 13 0
Westminster Ordinary	1	15	8½	25/-	—	5 12 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/3	—	7 8 2
Yorkshire Elec.	1	8	8	20/6	—	5 8 4
Home Rails.						
Central London Ord. Assented	Stock	4	4	70	—	5 14 4
Metropolitan	,,	5	9	62½	—	4 16 0
do. District	,,	3½	3½	59	—	5 18 8
Underground Electric	£1	Nil	1½	16/6	+6d.	1 16 4
do. do. Income	Bonds	6	6	102	—	*5 17 8
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	100	—	6 0 0
do. Def.	,,	1½	1½	23[illegible]	—	6 6 0
Automatic Telephone	1	3	10	48/9	—	4 2 4
Chili Telephone	5	5	6	6[illegible]	+[illegible]	4 13 2
Cuba Sub. Ord.	10	5	5	7	—	7 2 10
Eastern Extension	10	10	10	17½	+½	*5 14 3
Eastern Tel. Ord.	Stock	10	10	172½	—	*5 15 10
Globe Tel. and T. Ord.	10	10	10	18½	—	*5 8 1
do. do. Pref.	10	6	6	10[illegible]	—	5 10 0
Great Northern Tel.	10	20	20	27½	+½	7 6 10
Indo-European	25	8½	10	46½	—	*5 7 6
Marconi	1	Nil	Nil	17/6	—	.. ..
Marconi-Marine	1	7½	8[illegible]	23/9	—	7 7 4
Oriental Telephone Ord.	1	12	12	52/-	—	*4 12 4
United R. Plate Tel.	5	8	8	8[illegible]	—	*4 11 5
Western Telegraph	10	10	10	17	—	*5 17 8
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	5	5½	5½	9[illegible]	—	6 3 6
do. do. 2nd Pref.	5	6	6	8[illegible]	—	9 1 2
do. do. 5% Deb.	Stock	5	5	71½	—	7 0 0
British Electric Traction Ord.	,,	8	—	149½	—	5 13 6
do. do. 6% Pref.	,,	6	6	109	—	5 10 1
Brazil Traction	100	5	6	137½	+1½	4 7 3
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	89½	—	5 11 9
do. do. Preferred	,,	6[illegible]	6[illegible]	116½	+1	*5 7 4
do. do. Deferred	,,	8	—	156	—	*5 2 9
do. do. Deb.	,,	4[illegible]	4[illegible]	79½	—	5 7 0
London & Sub. Trac. 5% Pref.	1	Nil	Nil	7/9	—	Nil
London United Tram. Deb.	Stock	4	4	51	—	7 16 10
Mexico Trams, 5% Bonds	—	5	5	73½	—	6 16 1
Mexican Light Common	100	Nil	Nil	45	—1	Nil
do. Pref.	100	Nil	Nil	107	+7½	Nil
do. 1st Bonds	—	5	5	68½	—	7 6 0
Yorkshire (West Riding)	1	5	—	8/9	—	.. ..
Manufacturing Companies.						
Babcock & Wilcox	1	13	13	55/-	+1/8	*4 16 8
British Aluminium Ord.	1	12½	10	44/6	+9d.	4 10 0
British Elec. Transformer Pref.	1	Nil	7	18/-	—½d.	7 9 0
British Insulated Ord.	1	15	—	70/-	—	4 5 9
Brush Ord.	1	10	—	28/3	—	7 1 7
Callenders	1	15	—	3½	—	4 5 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	£/-	Nil	Nil	10/-	—	.. ..
Edison-Swan	£/-	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	85	—	5 17 8
Electric Construction	1	10	—	80/-	—	6 13 4
Enfield Cable Pref.	1	7½	7½	1[illegible]	—	6 6 4
English Electric	1	Nil	Nil	10/-	—	.. ..
do. do. Pref.	1	3	—	12/6	—	.. ..
Gen. Elec. Pref.	1	6½	6½	23/6	—	5 10 8
do. Ord.	1	7½	—	30/6	—	4 18 4
Henley	20	—	—	90/-	—	4 8 11
do. 4½% Pref.	5	4½	4½	4[illegible]	—	5 6 0
India-Rubber	1	5	5	1	+[illegible]	*5 0 0
Johnson & Phillips	1	17½	—	2[illegible]	—	7 7 4
Met.-Vickers Ord.	1	8	8	27/6	—	5 11 4
do. Pref.	1	8	8	2[illegible]	—	6 14 9
Siemens Ord.	1	7½	—	26/9	—	5 12 9
Telegraph Construction	12	10	10	29½	—½	*4 4 2

* Dividends paid free of Income Tax.

The Electrical Industry and Market.

The Influence of Other Trades and Industries.

THE second quarterly trade survey published by the British Electrical and Allied Manufacturers' Association (5s. net) is a study of the economic situation in the leading industrial countries, and an attempt to forecast future developments in which the electrical industry is not treated separately but as a section of the economic framework. The familiar broad aspects are restated, *e.g.*, the growth of productive power as a consequence of the war, increased protective tariffs, the reduction of national wealth in European countries, &c. To the coal dispute of last year is mainly attributed the fact that Germany is at the moment the only country which can point to improvement in industrial production. There are factors at work which will induce still greater reductions in the price of finished German goods to enable them to compete, but the competitive situation is not so favourable now, and trade will react at once. There are few indications of any growth of demand in the more important markets upon which the prosperity of Europe depends.

Dealing with the basic industries, the report urges the importance of coal, iron and steel to the electrical industry; over 40 per cent. of the industrial motors in Great Britain have been installed in these industries, and they may be the decisive factor in the expansion of the industrial branch of the electrical industry for a considerable time to come. With regard to the coal industry, it is pointed out that prices have not yet regained the pre-dispute level, and this is an important point in favour of electric power in industry; dear coal affects the price of electricity less than it affects the cost of production in non-electrified works. Complaint is made that the home industries are being unfairly treated to expand the exports of coal. The British iron and steel industry, when compared with the German industry, is said to be 700,000 h.p. of electric motors behind.

The official indices of the state of industrial production upon the 1913 basis are shown to be open to amendment; it is alleged that they have not taken full account of the changes in direction which have been made since then. It is stated, for instance, that while our exports of textile and agricultural machinery and machine tools outweighed all other branches of the industry until a few years ago, electrical machinery and apparatus, with steam turbines, boilers and condensing plant now come easily first, with automobiles second; agricultural machinery is near the bottom of the list. In many industries, of which electrical engineering is one, Germany has definitely lost ground as company with Great Britain. A study of the state of industrial activity leads to the conclusion that recovery from the effects of the coal stoppage has not been rapid enough. Coming to the electrical industry, the report deals with the effects of last year's troubles, but it is stated that the rate of expansion of electricity supply is now greater in this country than in the United States, Canada or Germany. Amalgamations in the coal and chemical industries are expected to lead to the wider adoption of electrical machinery, and the fact that only improved equipment can make the iron and steel industry able to compete is expected to lead to orders from this direction. Only financial difficulties, coupled with a certain amount of prejudice, have retarded electrification in the cotton industry. After remarking upon the high degree of industrial electrification in Germany, which is now greater than in the United States, the survey deals with the deficiencies of British industries. A table of estimated arrears for seven industries gives a total of 2,032,000 h.p. (including coal mining, &c., 800,000 h.p.; iron and steel, 700,000 h.p.; and cotton textiles, 500,000 h.p.). These industries are said to represent only 50 per cent. of the total, and it is therefore computed that the aggregate shortage is in the neighbourhood of 4,000,000 h.p., or about 70 per cent. of all the electric motors at present in operation. These statistics aim at illustrating the immensity of the field waiting to be cultivated by the electrical manufacturer, and at the same time the serious handicap under which he labours in his struggle against German and American competitors. The American manufacturer, with American industry employing 24,000,000 h.p. of electric motors, has four times the market, and the German manufacturer more than twice the market, open to the British manufacturer, who must suffer, in addition from the effects of unrestricted competition at home. The real disadvantage *vis-à-vis* the United States and Germany is about 6 : 1 and 3 : 1 respectively. While the Americans and Germans can embark upon large-scale production, the British manufacturer, forced to discover 30 per cent. of his market overseas, cannot standardise or specialise, and therefore mass production cannot be widely adopted.

The position in British industry itself, through its inability to adopt electrical machinery, threatens a crisis in production which can only be avoided through a policy of renewals and replacements and extensions of manufacturing plant of the most far-sighted and thorough nature. A national electrification policy is necessary to the realisation of sounder competitive conditions and the restoration of trade activity. In 1926 the electrical industry reported a record flow of orders; there are indications that a similar result will accrue this year, provided that progress is begun on the national power scheme. In the small industrial motor section, however, conditions were unsatisfactory through the inability of industry and transport to earn sufficient profits to justify the installation of electrical plant. The financial reconstruction undergone by a number of large industrial undertakings, with a resultant difficulty in raising new capital, is thought to be an adverse influence so far as the electrical industry is concerned. On the generating side the orders already received will give continuous employment for the rest of the year; on the heavy industrial side, coal-mining and steel orders are beginning to materialise, and may possibly reach a satisfactory total before the end of the year; but activity is less pronounced in the manufacture of cables. Great Britain maintained the position, gained in 1925, of chief supplier to the world's electrical market and held its ground in the first two months of 1927. A table shows that in the latter period exports amounted to £3,257,263, against £2,941,868 in January-February, 1926. Germany's exports increased from £2,778,500 to £2,781,050, and those of Switzerland from £299,130 to £338,290. The export position is satisfactory at the moment as a result of heavy orders placed by Australia, New Zealand, South Africa, India, Japan, Russia, and Argentina during 1926, while the restoration of normal exchange conditions in Europe has stimulated the demand for generating plant and switchgear. During the last three years Britain has held, and continues to hold, its own in generators, motors, convertors, and switchgear; in batteries and accumulators its position has improved; while in insulated wires and cables a fairly steady decline has taken place, Germany forcing out both Britain and the United States. In telegraph and telephone apparatus, excluding wire, a similar change in position has occurred. Germany and Switzerland supply the bulk of the world demand for meters, the share of Great Britain being less than 10 per cent.; and in lamps the competitive situation is equally unsatisfactory.

Since the beginning of the year a marked improvement has resulted in exports of insulated wire and cables, but a decline has occurred both in telegraph and telephone apparatus and lamps. In electrical machinery the upward movement in British exports continues, accompanied by a similar development in Switzerland, while a decline has occurred in the United States and Germany. As a part of its efforts to capture foreign trade, Germany has reduced the prices of its motors, and now with Switzerland and France is well below the British level. The difference in price is increasing presaging intensified competition. The cost of living in the competing countries tends to a common level, but it remains too high in Britain, and the gap between wholesale and retail prices must be reduced if labour troubles are to be avoided. The competitive position is full of uncertainty; stocks are low in the majority of industries, so that a lowering of prices can be operative at once, but there is a danger of destroying the real profit basis of production and seriously weakening the market. The position of the British electrical industry is fairly sound even at present price levels, since quality and efficiency of operation have decided the issues in almost every important contract, but the persistence of the downward movement in wholesale prices must react also on the British manufacturer and cause a narrowing in the available markets. The survey concludes with a general forecast of trade conditions. It is pointed out that while currency stability has been reached, this stability is due more to the deliberate policy of financiers than to a revival of international trade, which is still depressed. There has been over-production accompanied by restriction of credit. Although Germany has been active, there are indications of a downward movement. Uncertainty exists in international trade with a marked tendency towards depression. Britain and France have followed Germany in the "rationalisation" of industry, and are offering strong resistance to German penetration of foreign markets. The position of the British exporter is not reassuring, but conditions may improve later in the year. If the national reorganisation of electricity supply is proceeded with immediately, the electrical manufacturer may escape almost wholly from the trade depression. There is still a shortage of about 600,000 kW of generating plant to be made good. The export position is strong; for six years Britain has more than held her own, but this year will be the most difficult and most decisive of all. The growth of amalgamation and trustification continues in Britain as well as in Germany, with the result that already important orders have been secured for electrical equipment in the heavy industries.

Two appendices to the survey review the German electrical industry, and they are followed by a series of curves and diagrams dealing with many phases of industry.

New Electrical Devices, Fittings and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Suspended Globe Fitting.

With a view to preventing the constant breakages of electric-fitting glassware which occur in large stores and similar establishments, due to insecure methods of fastening, the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2, has evolved a patent safety canopy fitting, which, it is claimed, entirely eliminates the possibility of dropping the globes, by means of a flexible incorrodible steel suspension wire which is securely attached to the supporting ring of the glass at two points and secured to a vertical winding drum in the crown of the fitting When it is desired to replace a lamp or clean the globe, the latter is released by means of a wing nut, when the drum will automatically unwind and lower the globe by means of the suspension wire, leaving both hands free to carry out the necessary work. To wind up, fig. 1, the canopy of the fitting, to which the drum is secured, is turned by one hand, the other being used to hold the gallery in position and act as a brake for the drum. The globe cannot, it is claimed, be left insecurely fixed, as unless the locking nut is screwed up, it will not stay in the closed position. The metal-work is of oxidised-copper finish, and the globe is of white low-absorption glass. The fitting is available in 14-in. and 16-in. diameter sizes, suitable for 100/150-W and 200-W lamps, respectively.

Fig. 1.—Winding-up Globe.

A Pole-Type Condenser.

The accompanying illustration, fig. 2, shows, in position, a l.p. pole-type condenser which is marketed by the Telegraph Condenser Co., Ltd., Southampton Street, High Holborn, London, W.C.1. The apparatus is intended for installation on the overhead transmission lines of distributing supply undertakings where bulk supplies are metered on kVA demand. In the case depicted the supply is distributed by 3,000-V lines, the pressure being transformed down by means of pole-type transformers. The condenser is connected direct to the transformer secondary, thus relieving the transformer itself of wattless current in addition to the overhead system generally. It is built into an outdoor type of tank with a specially constructed lid, and is provided with a water-shed terminal cover. The tank is fitted with pole-hanging straps. The apparatus illustrated has an output of 7 kVA when working at 400 V, and is one of a large number supplied to one undertaking. The voltage regulation of the system has been materially improved, quite apart from the decrease in kVA demand, which resulted in a very substantial reduction in the power bill. The l.p. 400-V supply in the case of this undertaking is distributed to farms where numbers of small motors are used and where individual power-factor correction would not be desirable, or, in fact, possible on commercial grounds.

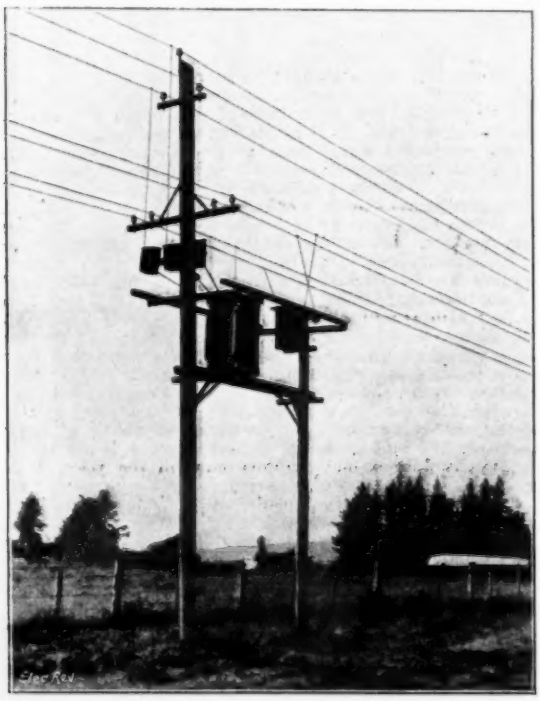


Fig. 2.—Pole Condenser and Transformer, in Position.

A Cable-Haulage Equipment.

A recent production of Messrs. F. T. Murdoch & Co., Ltd., Thompson Street Works, Belfast, is a new patent winch, fig. 3, specially designed for pulling cables through conduits. It is

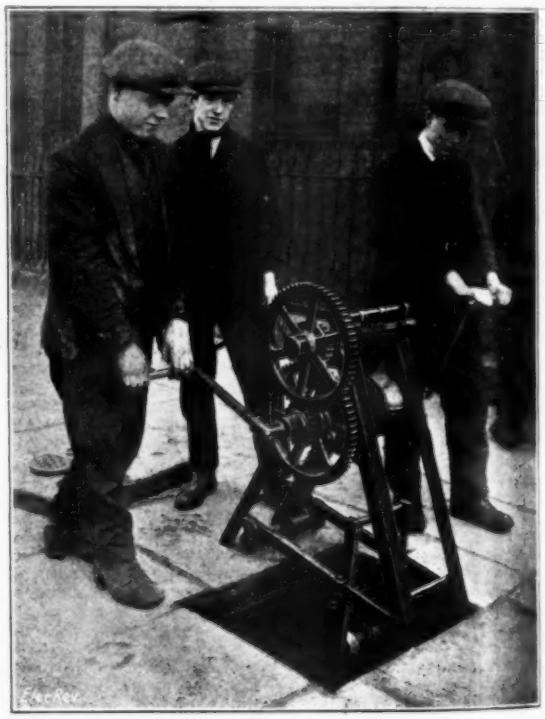


Fig. 3.—A Cable Winch.

claimed to be stable and to require no weights to hold it down. The hauling rope passes over a guide, which leads the rope directly from the centre of the conduit, and can be adjusted so as to eliminate all friction against the corner of the manhole, &c. The rope is next led over the sheave provided at the rear side of the winch, and goes thence to the winding drum. The apparatus can be placed over any part of the manhole so as to allow a workman clear passage into the hole, and central fixing over the particular cable which is being worked on. Three speeds are provided, giving ratios of 9 to 1, 3 to 1, and 1 to 1. Only two axles are employed, and none of the usual clutches or drop bars.

A Radio Valve Testing Machine.

A machine which tests thermionic valves more rapidly than the most expert human operator is in use at the factory of the Westinghouse Lamp Company at Bloomfield, N.J., U.S.A. The capacity of the machine is 30,000 tubes a day, and for the period of several months during which it has been in service its record for accuracy stands at 99.9 per cent., the 0.1 per cent. error being chargeable to the accidental introduction of defective valves into the good stock. The machine was invented by Mr. Allen B. Dumont, of the Westinghouse

Company, and its operation is simple. It consists essentially of a revolving disk, about 3 ft. in diameter, which carries sockets for valves on one of its faces; as the disk revolves, the valves are connected successively, a defective one being knocked out of its socket by an electromagnetically acting plunger located at the rear of the machine. Valves that are hopelessly bad are unceremoniously shot on to the scrap heap; but those which can be reclaimed are gently laid on to moving belts which convey them to operators for further treatment; good ones are also placed on a belt and carried to the wrapping department. The valves are tested for short circuits, broken filaments, emission, gassiness, and high and low plate current; some of the tests involve the use of extremely small currents, and special sensitive relays are employed to operate the ejecting mechanism. Each test is a positive one, and each testing mechanism will eject a valve if it should be damaged during the process of testing. The machine is arranged to be fed by two girls seated side by side, one of whom must be left-handed and the other right-handed, but it will soon be re-arranged to be fed automatically in order to bring it up to its full productive capacity.

The Electrical Imports of Ceylon.

THE following table shows the value of Ceylon's imports of electrical and allied materials during the past year. The figures have been taken from the recently published official returns. The corresponding statistics for 1925 have been added and notes of decrease or increase are also given :—

	1925. Rupees.	1926. Rupees.	Inc. or dec. Rupees.
Control and switchgear—			
Total, all from United Kingdom	8,000	36,000	+ 28,000
Generators, alternators and dynamos—			
Total	175,000	192,000	+ 17,000
From United Kingdom ...	166,000	183,000	+ 17,000
„ Germany	2,000	4,700	+ 2,700
„ United States	3,600	2,600	− 1,000
Motors—			
Total	20,000	47,000	+ 27,000
From United Kingdom ...	17,000	43,000	+ 26,000
„ United States	2,000	4,000	+ 2,000
Transformers and convertors—			
Total	500	5,000	+ 4,500
From United Kingdom ...	500	3,500	+ 3,000
„ United States	—	1,500	+ 1,500
Magnetos, ignition—			
Total, all from United Kingdom	120	1,400	+ 1,280
Magnetos, road—			
Total	16,000	11,000	− 5,000
From United Kingdom ...	11,000	7,000	− 4,000
„ Germany	4,000	3,000	− 1,000
Electric wires and cables (insulated)—			
Total	272,000	289,000	+ 17,000
From United Kingdom ...	262,000	273,000	+ 11,000
„ Germany	1,000	1,600	+ 600
„ United States	2,400	500	− 1,900
„ Holland	1,600	3,600	+ 2,000
Electrical machinery not elsewhere specified—			
Total	139,000	354,000	+215,000
From United Kingdom ...	100,000	252,000	+152,000
„ Germany	3,000	5,400	+ 2,400
„ United States	33,000	48,000	+ 15,000
„ Italy	3,000	9,500	+ 6,500
Telegraph and telephone instruments and apparatus—			
Total	213,000	285,000	+ 72,000
From United Kingdom ...	181,000	257,000	+ 76,000
„ United States	16,000	8,600	− 7,400
„ Sweden	8,000	3,400	− 4,600
Electric lighting accessories and fittings, including switches—			
Total	305,000	354,000	+ 49,000
From United Kingdom ...	209,000	248,000	+ 39,000
„ Germany	38,000	42,000	+ 4,000
„ United States	29,000	23,000	− 6,000
„ Holland	18,000	29,000	+ 11,000
Electrical goods and apparatus not elsewhere specified—			
Total	581,000	426,000	−155,000
From United Kingdom ...	518,000	332,000	−186,000
„ India	13,000	17,000	+ 4,000
„ France	3,000	6,400	+ 3,400
„ United States	38,000	48,000	+ 10,000
„ Germany	5,000	12,000	+ 7,000

Turbo-Generator Construction in Russia.

AS we recently reported, an attempt is being made greatly to extend the construction of steam turbo-generators in Russia. At the works of the Electroforce (Elektrosil) in Leningrad the construction of 5,000-kW sets has been begun for the first time in Soviet Russia. At the same time preparations have been completed for the turning out of similar sets of 10,000 kW, the patterns and drawings having already been finished. These machines are intended for the stations at Kieff, Novorossisk, Kizel, &c. The works, which belongs to the State Electrical Trust, claims to have orders on hand for 44 turbo-generators of a total of 240,000 kW. In connection with the development of this branch large orders for milling and other machines were placed abroad and this plant is now beginning to arrive in Leningrad.

Still further expansion is proposed by the Metallurgical Works in Leningrad in the matter of steam turbines. This undertaking has started the erection of a new large turbine shop which with a full load, it is claimed, will be able to turn out turbines of a total of 325,000 kW per annum, or nine times more than the existing shop is able to construct at the present time. According to the scheme, the costs of production will at the same time be reduced by not less than 20 per cent. The new works will be equipped with foreign machines which will permit of a very considerable extension of the production while only involving the doubling of the number of men employed.

The general work of electrification and industrialisation is bringing about an increasing demand for steam turbines. Prior to the war the construction of turbines was carried on only to an inconsiderable extent; the maximum power was only 1,250 kW. Altogether between 1905 and 1914 the Metallurgical Works, above mentioned, only turned out 44 turbines of a total of 50,000 kW. After the war, work on turbines was only recommenced at this particular works in 1921, when works of repair were executed. New turbines were begun in 1924, and now the works is building machines up to 10,000 kW, these being for the Southern Steel Trust. This size has not exhausted the capabilities of the works as, at the request of the Electric Current Undertaking (Elektrotok), a scheme is being worked out for the construction of two 20,000-kW steam turbines. In this connection it is mentioned that turbines are being made not only for normal pressure but also for higher pressures, and this year a turbine for about 440 lb. per. sq. in. will be turned out for the Vladimir-Alexandroff Textile Trust. At the same time turbines for 580 lb. per sq. in. with a capacity of 5,500 kW are to be made for the Krasny Treugolnik works. The technical possibilities of the existing turbine works was limited because it was only able to turn out machines of a total of 35,000 kW per annum, but the demand has exceeded this capacity many times over, so that it was decided to erect an entirely new and large works. A beginning was made last year and the completion of the first portion is expected to take place next year, the total expenditure being 5,800,000 roubles. The works will consist of 18 bays and will be, it is claimed, one of the largest in Europe intended for the construction of steam turbines. Last year three bays were finished, nine are to be completed this year, and the remaining six next year. In the current year a start will be made with the erection of the machinery, part of which has been ordered abroad, and thus the possibility exists that work on machine construction will begin next year. The final equipment of the works will be effected in 1930-31, when the demand for turbines, according to the General Metal Trust, will represent 450,000 kW per annum, which output the new works will be able to cover entirely.

Leningrad does not stand alone in the work of the development of the construction of turbines, as the Moscow Machine Trust is also working in the same direction, particularly with hydraulic turbines. Three such turbines of 3,600 h.p. are being built for the Swiran hydro-electric works, and it is stated that the works will now be able to construct similar turbines of up to 10,000 kW.

The Elimination of Waste.

The Report of the U.S.A. National Committee on Metals Utilisation ("Simplified Practice Recommendation, No. 37"; Government Printing Office, Washington, price 5 cents) gives the sizes of wrought iron and steel pipes, valves and fittings adopted at a general conference last year, which are said to fill over 80 per cent. of all normal requirements. Eighteen diameters are quoted between ¼ and 12 inches (nominal), with three grades of thickness. It is stated that "the combined efforts of this general conference resulted in a reduction from a total of 62 sizes to 49 sizes of pipe, corresponding to an elimination of 20.96 per cent. and an elimination of 762 sizes of valves and fittings, or a 3.8 per cent. reduction in the current variety. . . . One concern has stated that their sale of the 44-, 7-, and 9-in. sizes alone represents only one-third of the investment that is required to produce them, so heavily does the fabrication and stocking of the odd sizes drain their resources."

New Drum-Type Controllers and Motors.

The development by the British Thomson-Houston Co., Ltd., of Industrial Equipment with "Unbreakable" Resistances.

WITH the object of affording reliability and convenience from an installation and maintenance viewpoint, the British Thomson-Houston Co., Ltd., has developed a new line of reversing drum controllers for electric motors operating cranes, hoists, and such-like industrial equipment. They differ entirely in construction from those hitherto manufactured, and incorporate features based on experience of steel-works' auxiliaries and other plant, the operating conditions of which are arduous.

Drum-Type Controllers.

This range meets the requirements for a.c. slip-ring induction motors up to 75 h.p. and for d.c. motors up to 120 h.p., both at 550 volts: the same features are common to both types.

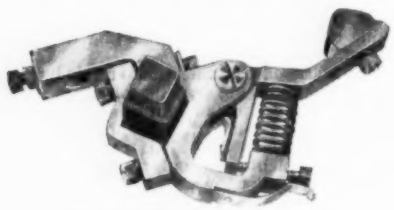


Fig. 1.—Pivoted Contact Finger.

The frame consists of separate top and bottom castings fixed together by steel bars and the sheet-iron back and front covers are both detachable so that the whole of the inside is accessible. The body of the drum consists of ribbed castings carrying the copper contact segments with their renewable arcing tips, and all the segments are of the same diameter. The starwheel is secured to the top of the cylinder, is designed to give positive notching at each starting point, and the pawl is fitted with a large roller and pin to obtain a maximum wearing surface.

All the contact fingers are built up of extruded sections: the fixed base is clamped on four sides of a mica-insulated square steel bar, and the moving part is attached to the fixed part by a pivot screw. The renewable tip is adjusted in relation to the segments on the cylinder by means of a screw which operates on an extension of the finger arm and is adjustable to one-sixth of a turn and automatically locked in position; the arrangements are shown in fig. 1. Pressure of the finger on the segment is maintained by means of a compression spring, which is free to function without friction on any part of the finger: the pivot is not used for carrying current, a flexible shunt being fitted between the moving

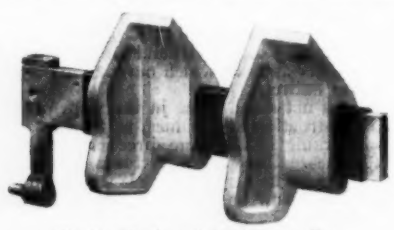


Fig. 2.—Portion of Arc-deflector Bar.

and the fixed parts, entirely enclosed, so that it cannot be accidentally damaged.

Any finger can be removed without disturbing the remainder, or taking out the whole bar, simply by taking out the cable and removing two screws. Interlocking fingers are provided, so that an electrical interlock exists between the controller and a protective circuit breaker, preventing the latter being reset unless the controller is in the "off" position.

Fire-proof arc deflectors between the contacts prevent cross arcing, the portion which acts as a barrier between each finger being moulded in one piece with the portion which is shaped to slip over and enclose the pole piece of the magnetic blow-out; screws are not used for fixing them, and to facilitate inspection the assembled deflector is hinged so as to swing clear of the fingers (figs. 2 and 3). A new type of crank handle has an automatic "off" position latch to prevent the handle being accidentally knocked into a running position, the latch mechanism being released from below the casting which forms the handle by the weight of the operator's hand on the top of the knob.

Controllers for a.c. duty are of similar design, as may be seen by reference to fig. 3, which shows that four arc deflectors only are required in this design, as cross arcing can only take place between the fingers in the stator circuits.

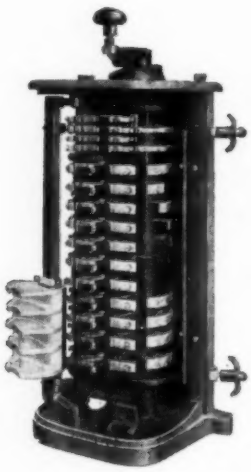


Fig. 3.—A.C. Drum Controller.

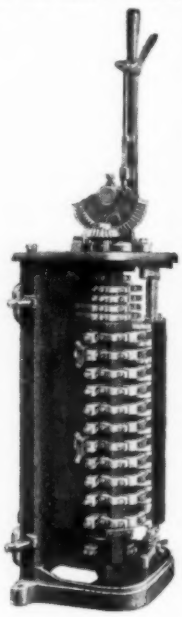


Fig. 4.—D.C. Drum Controller with Vertical Lever Gear.

All the controllers can be fitted, if desired, with lever mechanism having either a vertical or horizontal "off" position; alternatively, a rope-wheel can be used in the case of the smaller sizes, and spring return mechanism can also be employed.

"Unbreakable" Resistances.

The B.T.-H. Company has recently perfected manufacturing equipment for producing new light resistance grids so graded that the temperature-resistance co-efficient usually associated with the "unbreakable" type does not adversely affect the equipment with which it is used: if specially required, grids can be supplied with practically a zero temperature-resistance coefficient. The resistance

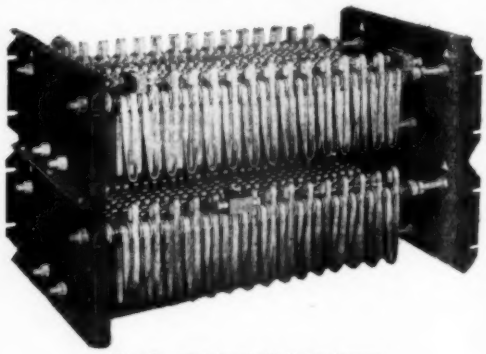


Fig. 5.—"Unbreakable" Resistance.

element is composed of a continuous strip, machine formed into grids, without joints between the two external terminals (fig. 5). High-resistance steel strip, heavily plated with zinc to render it rustless, is generally used, but in some cases another rustless material may be used for the smaller sizes.

Resistances can be supplied in any of the combinations already adopted for cast grids: for crane service each bank is mounted in a separate box, consisting of two pressed-steel end-frames so flanged that any number of boxes up to six

may be bolted together to form a self-contained unit. The grids are supported between the end-frames by four mica-insulated steel bolts, adjacent grids being insulated from one another by mica washers between steel washers. Another feature is the method of mounting the terminals so as to ensure good contact between terminal and resistance, and also rigid support for the incoming cable: the terminals are of extruded brass section and are bolted to a loop in the grid immediately above one of the insulated bolts for all units up to approximately 200 amperes at the 5-minute rating.

Motor Developments.

Some interesting features can be recorded in connection with a range of a.c. and d.c. motors, U-type, which has recently been put into production by the British Thomson-Houston Co., Ltd. The range covers sizes from ¼ h.p. up to about 40 h.p. for squirrel-cage machines, up to 15 h.p. for slip-ring machines, and from ¼ h.p. up to 35 h.p. for d.c. machines; the latter are suitable for conversion as generators. The machines all comply with the B.E.S.A. requirements; they can be supplied with any of the usual types of enclosure and all of them incorporate end-shields spigoted into the cast-iron frames. The peripheries of the shields are machined, ensuring close-fitting joints between them and the enclosing sheet-steel covers; the latter are interchangeable. Fig. 6 shows a protected d.c. machine.

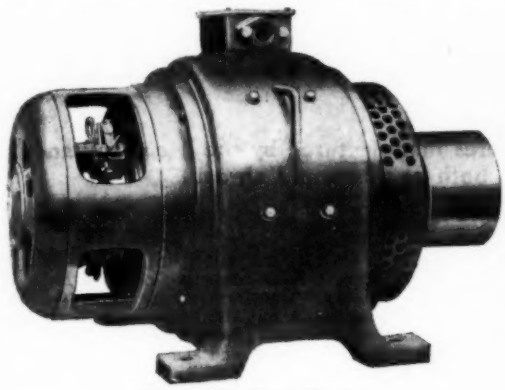


Fig. 6.—D.C. U-type Motor.

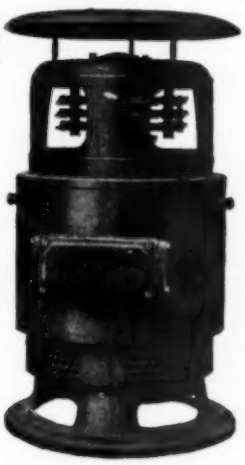


Fig. 7.—Vertical Induction Motor.

On each motor a roller bearing is fitted at the driving end and a ball bearing at the other end, whilst any of the motors can be used with its shaft at a given angle from the horizontal or vertical, as the case may be, and with the provision of special bearings, if necessary, the motor will run in any position between horizontal and vertical. Fig. 7 shows a vertical protected slip-ring induction motor. The skirt-base casting is separate from the end-shield casting, so that machine makers can readily fit their own adaptor rings to obtain the necessary drive. The construction of the stator is claimed to be such that the air gap will be correctly maintained.

The rotor construction of the squirrel-cage motor is interesting, in that there are no joints in the cage, and as only one metal, aluminium, is used for both the bars and end rings, the rotor is immune from fracture due to unequal expansion. The bars and end-rings are cast in one piece by a patented centrifugal process which, it is claimed, ensures both absolute uniformity of texture and absence of blow holes or air pockets.

The slip-ring rotors are fitted with bar-type windings on account of the simplicity and mechanical rigidity of the latter, and also because of the open spacing obtained at the end connections; this construction renders them particularly suitable for high speeds.

On the d.c. brush equipment the pressure fingers are designed to give uniform pressure on the brushes throughout their life, and the pressure can be readily adjusted without lifting the brushes. The brush holders are covered with moulded-on non-hygroscopic insulation, and their adjustment can be effected in an axial direction. The brush stud is directly attached to the yoke, and consequently the brush-gear is free from the possibility of the brush stud working loose and rotating due to shrinkage of the insulation. The brushes conform to the dimensions given in B.S.S. No. 96, and as the pig-tails are attached to the same terminals on the brush-holder as those for the machine leads, the brush current does not have to pass through any part of the brush-holder.

The a.c. brush-gear is insulated in a similar manner.

Mercury-Contact Motor Starters.

A New Multiple-contact Tilting Switch.

THE disadvantages with which the use of mercury-contact switches has been associated in the past are claimed to have been overcome in a new design of mercury multiple switch which has been embodied by Messrs. Isenthal & Co., Ltd., in a new range of motor starters which they have recently adopted.

Fig. 1. Mercury Container, Bottom.

The essential part is a specially designed mercury container which, by a tilting operation, makes or short-circuits the necessary step-resistance units of the starting apparatus. The container consists principally of two parts, box and lid, made of a moulded insulating material with perfectly machined contact faces, so that when screwed together they form a perfect seal for the mercury and an air-tight box. Fig. 1 shows the bottom section of the device in which are moulded the necessary mercury cups, channels, and reservoir. In the "off" position the mercury is contained in the last mentioned compartment, at the top, by virtue of the tilt of the box in the required direction, but when the opposite inclination is given to the device, the fluid runs through a calibrated aperture on the left, thus gaining access to the several cups. These are made of steel and at the back are provided with

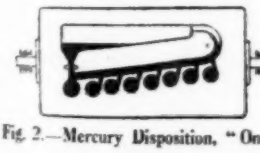


Fig. 2.—Mercury Disposition, "On."

Fig. 3.—"Off" Position.

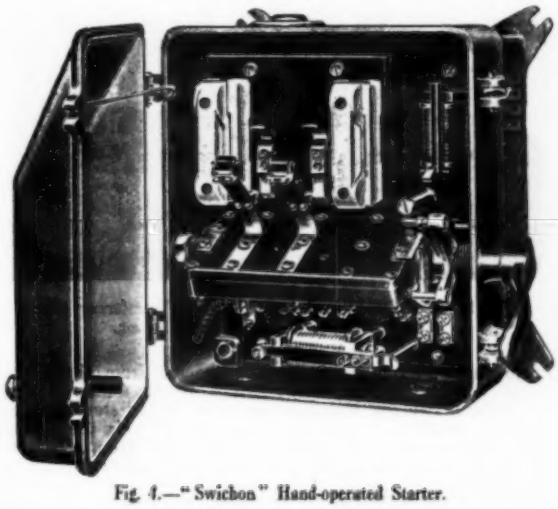


Fig. 4.—"Swichon" Hand-operated Starter.

screw studs and nuts for the resistance connections. The shape and grading of the channels and cups are such that the mercury stream carrying the current cannot break, except when required, at the point of contact, and that at each cup it immediately coalesces with the small amount of the substance which is retained therein. A small projection at the opening to each cup causes the mercury to collect there and then drop into the cup in bulk, so that full contact is made from the first.

The important feature of the apparatus is that the mercury functions in inert gas, eliminating the objection to sparking at the contacts. The chamber is air-tight and the small amount of air which is enclosed on assembly of the container is rendered inert after a few operations. It is obvious that once the box has been tilted into the "start" position the process of starting is quite automatic and independent of the operator. When the apparatus is tilted back again into the original position the mercury flows back into the reservoir through the channel at the opposite end to the entrance gate. Figs. 2 and 3 show the mercury disposition at the "on" and "off" positions of the container respectively.

The makers have incorporated this mercury-containing device in four types of "Swichon" starting apparatus, providing for hand, electrical, or mechanical operation, remotely or directly. Fig. 4 shows a simple starter of the first type for controlling small motors up to 5 h.p. For the control of larger motors it is intended to utilise the mercury tilting box as a master controller, operating a suitable set of contactors for the resistance stages or winding combinations. It should be mentioned that the actual breaking of the main circuit is performed outside the box, in order to totally eliminate any possibility of sparking on the mercury.

In conclusion, attention must be drawn to the one limitation of the mercury starter described above: it is not suitable for use on board ship or aeroplane for obvious reasons.

Some Recent "Metrovick" Contracts.

Examples of plant of large size and special features manufactured by the Metropolitan-Vickers Electrical Co., Ltd., for use both at home and abroad.

A FEW years ago an impression seemed to be prevalent that the construction of transformers of very large capacity, or for service at extra-high-voltage, was beyond the capability of British manufacturers. It is accordingly satisfactory to know that the ability of British firms to carry out such work has been amply demonstrated.

With regard to home contracts, what are described as the largest single-unit transformers yet made in Great Britain were built for extensions to the Barton power station of Manchester Corporation: they are three-phase, core-type units of 25,000 kVA each, with a voltage ratio of 6,600 to 33,000 volts, and are to be installed with the 41,000-kW steam turbo-alternator set recently ordered from the above-named company. The present British record for large capacity units is held by Metropolitan-Vickers main step-up transformers already in commission at Barton, *viz.*, six three-phase units, each of 19,500 kVA capacity, which have been in successful operation for about four years; one of these transformers, photographed recently while removed from its tank for inspection, is shown in fig. 1. In design, the new transformers will be similar to the original ones, arranged for forced cooling, and will be nearly 16 ft. long, 7 ft. broad, and 17 ft. in height to the top of the high-voltage terminal.

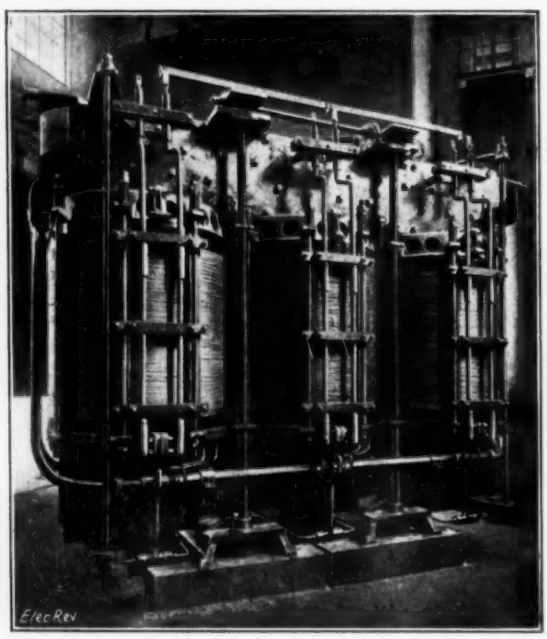


Fig. 1.—A 19,500-kVA, 3-phase, 50-period Transformer after 4 years' service in Barton Power Station.

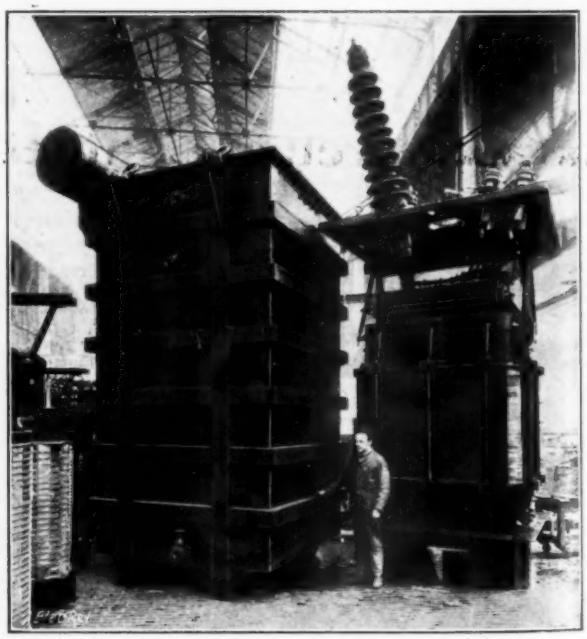


Fig. 2.—Single-phase Transformer of 11,000 kVA Effective Rating, one of many for service on a 132,000-volt system in South Africa.

Amongst transformers being supplied on foreign contracts are three-phase banks up to 54,400 kVA capacity per group: two banks of this capacity and one spare unit are being sent to South America, each bank consisting of three 18,113-kVA, single-phase, shell-type transformers for 13,650/28,500-volt operation at 50 periods; they will be fitted with oil conservators and breathers, two sets of cooling equipment per group being included in the contract, and the guaranteed maximum efficiency of these transformers is 99.34 per cent.

A 51,000-kVA bank of similar type, but designed for operation at 6,600/115,000 volts on outdoor service, is being built for a power station in Europe. The units of this group, as well as those of the 54,400-kVA groups above-mentioned, will be of greater capacity than any single-phase units hitherto manufactured in this country. Some idea of the size of the plant now being built may be obtained from fig. 2, which shows one of the single-phase units recently manufactured at the Metropolitan-Vickers works for the Victoria Falls and Transvaal Power Company, South Africa. The initial power plant which is being supplied by the company for the new Waikaremoana hydro-electric power station in New Zealand includes two 20,000-kVA, three-phase banks of single-phase transformers and one spare 6,666-kVA single-phase unit, water-cooled and arranged for outdoor service at 11,000/110,000 volts. The Great Indian Peninsula Railway has ordered 12 single-phase transformers, of the self-cooled outdoor type, to form four 11,000-kVA, three-phase banks for 6,600/110,000-volt

operation in connection with the electrification of the main railway line north-west from Bombay.

Within the last few years Metropolitan-Vickers transformers aggregating over half-a-million kVA total capacity have been ordered and supplied for pressures of 110,000 volts and above, and the company is now completing extensions to its high-voltage laboratory, which will increase its capacity by over four times and include transformers for making commercial tests at one million volts.

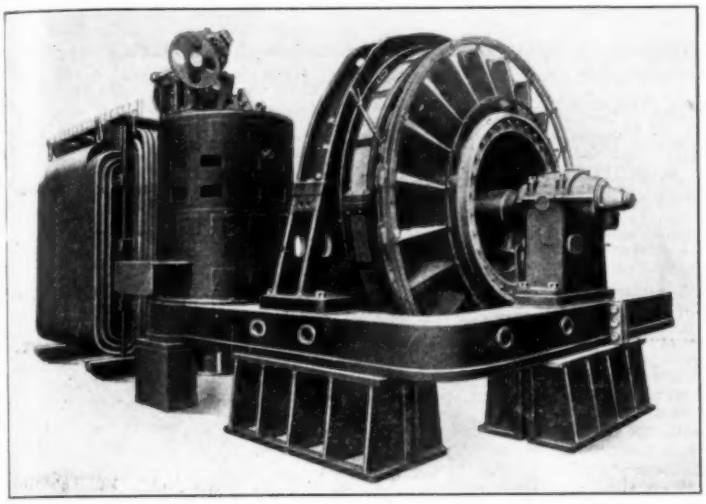


Fig. 3.—Rotary Convertor, with Induction Regulator and Transformer.

Four rotary-convertor sets with special features have recently been completed by the company for sub-stations in Buenos Ayres; three are of 3,000-kW capacity each, and one is of 2,000 kW. Apart from size, the equipments are interesting in that they include induction regulators to provide wide voltage regulation, together with power-factor correction: moreover, the heavy control gear necessary for such large machines is electrically operated, and the motors for operating the induction regulators and the field rheostats are remotely controlled.

The incoming supply to the sub-station is at 27,500 volts, 3-phase, 50 periods. The transformers of the rotary sets are oil-immersed and self-cooled, three single-phase shell-type units in one tank for each of the 3,000-kW sets, and a 3-phase core-type unit for the 2,000-kW set. All four sets deal with either 3-wire 440-volt lighting, or 2-wire 580-volt traction load, this unusually wide range of d.c. pressure being obtained by means of the induction regulators. Fig. 3 shows one of the convertors, with its transformer and induction regulator, in the makers' works. The output of each 3,000-kW convertor is 6,800 amps. at 440 volts and 5,200 amps. at 580 volts; provision is made to carry a mid-wire out-of-balance current of 1,700 amps., and the machines run with a leading kVA in order to improve the power factor of the system. At full load, 1,900 wattless kVA is supplied by each machine when operating at 580 volts and 0.85 leading power factor on the h.p. side, and 1,000 kVA when operating at 440 volts and 0.95 leading power factor. The larger rotaries are tap started, a small motor-driven high-pressure oil-pump being provided to force lubricate the bearings in order to reduce the power required for starting.

The 2,000-kW set is similar, but is provided with a directly-connected starting motor on the Metropolitan-Vickers self-synchronising system.

The induction regulators are vertical, air-cooled, motor-operated, and forced ventilated by a motor-driven fan. The rotor movement, by which the regulator boost is varied, is effected by means of a small motor with worm reducing gear mounted on the top of the regulator. The motor controller-type switch is on the operator's panel, and a magnetic brake on the shaft ensures that movement of the regulator ceases immediately the motor is switched off; limit switches and mechanical safety stops are also fitted.

The control gear for all four sets is remote electricity operated; fig. 4 shows the main contactor panel of one of the 3,000-kW sets, while fig. 5 shows the panel carrying the knife-switch push buttons and small contactors from which the massive main contactors are operated. The control gear is on a separate 180/230-volt d.c. circuit, and interlocks provide that the contactors can only be closed in their correct sequence. The two controller-type switches on the panel are for the induction-regulator and field-rheostat motors respectively; the three-pole knife-switch is for the oil-pump motor.

Control gear of this type, in some cases accompanied by synchronising apparatus, has been supplied by the Metropolitan-Vickers Electrical Co. for installations including rotary convertors up to sets of 4,500-kW capacity.

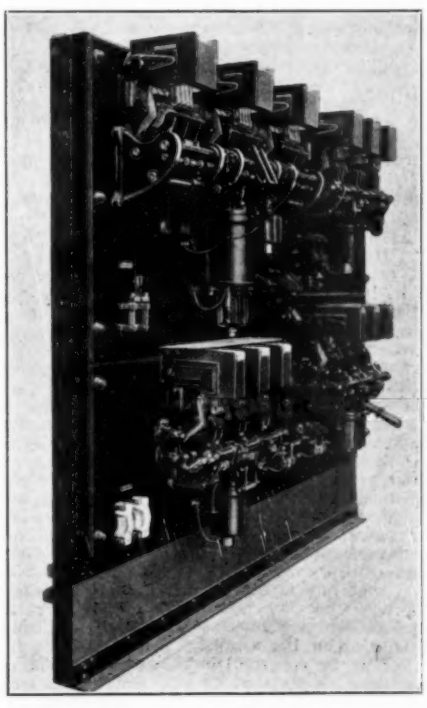


Fig. 4.—Main Contactor Panel for 3,000-kW Set.

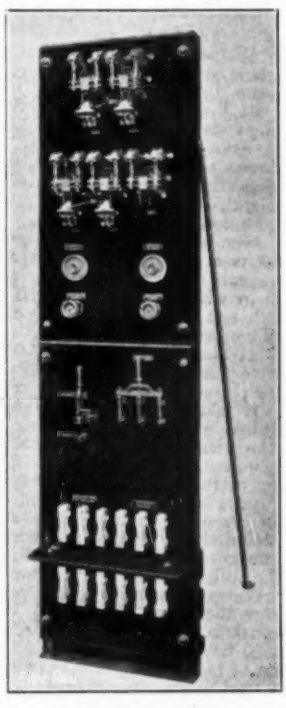


Fig. 5.—Control Panel for Large Machine.

Low-Loading Electric Vehicles.

For some time past commercial motor-vehicle practice has tended to lower the loading platform level, and builders of industrial electric vehicles are adapting their productions to the new order of things. Some time ago the Glasgow Corporation invited tenders for a fleet of thirty-six refuse-collecting vehicles, affording a large carrying capacity, low-loading line, small turning circle, and adequate sanitary protection for the contents. Many tenders were received, of which that of Messrs. Richard Garrett and Sons, Ltd., was accepted. The first vehicle has recently been delivered and is now on trial in Glasgow. The design enables a loading-line of 4 ft. 8 in. to be obtained, without reducing to any considerable extent the diameter of the road wheels. The driver's cab is well forward, the front axle being unusually far back, so that the vehicle has the large load-carrying capacity of from 4 to 5 tons on a comparatively short wheelbase. The Tudor battery is located above the front wheels and behind the driver's cab.

An electric vehicle recently supplied by the General Vehicle Co., Ltd., to the electricity department of the Manchester Corporation, took the form of a short-wheelbase tractor with a long low-platform two-wheel semi-trailer, the whole forming a flexible six-wheel vehicle specially designed for the transport of electric cable drums. The motor is so arranged that it drives a differential shaft by an enclosed silent chain, side roller chains transmitting the power to the rear wheels of the tractor. The battery consists of 44 Exide-Ironclad cells of 500 amp.-hour capacity, and is carried above the frame of the tractor behind the driver's cab; the cells are mounted on transverse rails, so that they can be readily removed through the sides. The trailer is designed to carry either a single 10-ton cable drum, or two smaller drums of 6 tons each. The tail board is hinged to the trailer platform, so that when lowered it forms a ramp up which the drums can be hauled by means of an electrically-driven winch on the vehicle.

Oil-Immersed Circuit Breakers.

A contribution to the study of the number of tests required to establish the rupturing capacity of an oil switch, in the form of a report (ref. G/T28) from the British Electrical and Allied Industries Research Association: startling conclusions are drawn.

By E. B. WEDMORE, M.I.E.E., W. B. WHITNEY, B.Sc.(Eng.), and C. E. R. BRUCE, M.A., B.Sc.

(*Abstract of Paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS.)

WHAT number of tests is required to establish the rating of an oil circuit-breaker? The purpose of this paper is to examine the problem and state conclusions in language as free as possible from technicalities.

The simplest case of a single-break circuit breaker controlling the circuit between two poles of a machine was studied first, but investigation of the three-phase case is also in progress, and sufficient work has been done to show its extreme complexity; however, at least the same degree of reliability from the results can be obtained on three-phase work by two-thirds the number of tests required on single-phase, but it would probably be unsafe to take one-third the number as sufficient, because the *range* of variation already observed in the total energy of the three phases in the relatively small amount of test data available is greater than the *range* of variation of the total energy of groups composed of three separate single-break tests based on a much larger amount of data. It might be argued that the authors are too conservative in this and that, since there are six breaks, one-sixth the number of tests is sufficient. Though they cannot agree with such a view, they point out that, even if it were accepted, it would not materially alter the main conclusions of their paper.

An analysis of a large number of repeat tests on a given oil circuit-breaker shows that the energy liberated at a single break of a single-pole breaker varied from about 1 to 50 kW-seconds, and the variation is as large on commercial breakers of about the same capacity. Hence a large number of repeat tests is required before a rating can be checked even to within, say, 50 per cent. of its true value.

Although the B.E.S.A. specification uses the ability to continue carrying rated current after clearing maximum rated kVA as the criterion of rating, this criterion affords no quantitative measure of the condition of the auxiliary contacts (which are the ones involved in clearing the circuit), nor does it take account of the possible expulsion of smoke, oil, or flame, which may be sources of grave danger to operators in the vicinity. Since a *quantitative* measure of efficiency is required, the authors have based their conclusions on a study of the magnitude of the arc energy liberated between the contacts, which may usually be considered amongst the main causes of destruction of switchgear. This energy can be definitely measured by means of oscillographic records of the current through, and the voltage across, the arc.

The authors have chosen a somewhat arbitrary maximum of 50 kW-seconds, but they are satisfied that any modification (under the given conditions) would not alter the general conclusions. For instance, the chance of the occurrence of, say, 30 kW-seconds or over is 1 in 14, *i.e.*, on the average, about 14 tests would have to be done before one occurred that was 30 kW-seconds or over; this at once shows that two tests cannot be hoped to give any reliable information. Further, the chance of getting, say, 47 kW-seconds arc energy output or over is about 1 in 1,000, or, on the average, about 1,000 tests would have to be done before one could be reasonably sure that the circuit breaker had been subjected to within a few per cent. of its worst strain.

In the commercial testing of heavy circuit breakers it is obviously impossible to do 1,000 tests, and we therefore want to know how near the truth we could get if we only do, say, 5, 10, or 20 tests. This is a problem in probability and the results of the author's calculations are shown in a family of curves (in the original paper) which indicate the manner in which the maximum values vary. Consideration of the maximum of a group of tests is unsatisfactory as an indication of the maximum possible and mean values do not materially reduce the limits of uncertainty.

Put in a rough-and-ready way, the authors' investigations indicate that if a single-phase, single-break circuit breaker twice clears, without serious distress, a single-phase dead short-circuit on a supply circuit capable of giving a maximum of, say, 10,000 kVA, all that can be assumed is that the circuit breaker is safe for operation on about 1/24th the kVA, or, say, 400 kVA. If it clears:—

5 tests at 10,000 kVA it is safe for operation on about 1/8th, or 1,200 kVA;

10 tests at 10,000 kVA it is safe for operation on about 1/5th, or 2,000 kVA;

50 tests at 10,000 kVA it is safe for operation on about 1/2, or 5,000 kVA.

This striking result indicates that there is little hope of being able to check the rating of an oil circuit-breaker by the methods usually accepted in commercial testing, even on three-phase work, without doing a prohibitively expensive number of tests. Moreover, the necessary number of tests would have to be greatly increased unless the arc energy output that will just cause a given criterion of distress is accurately found by some other means. Such means must allow of the stress-producing forces being rigidly controlled and increased little by little in suitably graded steps, but this is a problem still awaiting solution. The two tests specified by the B.E.S.A. specification are thus totaly inadequate. These results are quite contrary to commonly accepted opinion and have only been possible owing to the large number of tests available.

So far we have only dealt with the *checking* of a rating, but the difficulties multiply when a manufacturer is faced with the problem of determining the rating of a new design of breaker. Two distinct problems are involved, namely:—

(i) What arc energy output and rate of output a given breaker will stand *between its contacts*.

(ii) Determining the kVA and other *external* conditions which, when associated with the operation of the circuit breaker, will never result in a greater energy output *within* the breaker than the safe limit determined under (i).

In the absence of any other aids, such as the B.E.A.I.R.A. is gradually securing, the manufacturer must start by making an intelligent guess at the rating before checking it by the process of repeat tests. A series of small steps may have to be taken, each requiring 50 tests, and even then, when the distress limit is reached, he cannot be sure that the energy released in the switch in any test has been appreciably more than half the possible maximum.

Unfortunately, we have not sufficient data to be certain that when the externally applied load, or kVA, is increased or reduced, the maximum release of energy inside the circuit breaker in a given number of tests is increased or reduced proportionately, so that it might be necessary to carry out even longer series of tests to determine the shape and limits of the distribution curves at various values of applied kVA.

The only solution of the problem appears to be the systematic discovery and study of every variable entering into the production of arc energy and the discovery of the laws governing the magnitude of these variables and their inter-relationship and the crystallising of this information in the form of a general formula. Such a formula would contain constants, some of which would undoubtedly have to be determined by a few tests on each new type of breaker at a current in the neighbourhood of its current rating, but once these tests have been carried out it should be possible to determine by calculation the limits of variation in arc energy that would occur in a given breaker operating under given circuit conditions.

The British Electrical and Allied Industries Research Association has been engaged for several years on a careful analysis of variables with this end in view and is now within measureable reach of success so far as the range up to 20,000 kVA (single-phase) at 6,600 volts is concerned, but, in regard to certain causes of variation, research at higher ranges may be necessary before the safety of applying the formula to such higher ranges is established.

In conclusion, the authors point out that their observations regarding the probability of occurrence of high values of arc energy after a certain number of operations give strong grounds for belief that unexplained failures of circuit breakers may not be due to mysterious over-voltages, or other bogies, but may simply have been the result of the circuit breaker operating at the bad end of its energy distribution curve, the rupturing capacity having been overestimated due to inadequate previous tests.

[The paper was illustrated with a kinematograph film. The research work was carried out at the Carville power station of the Newcastle-upon-Tyne Electric Supply Co.—EDS., ELEC. REV.]

Discussion.

MR. G. W. PARTRIDGE, in opening the discussion, said he was disappointed in the paper in that he thought the authors should have arrived at something more definite. At Deptford many severe "shorts" were experienced—in one day as many as 50 occurred—and they all happened with a power factor varying from 50 to 75 per cent. Years ago he installed a new oil switch which normally carried only 1 or 2 A. It blew up the first time it was operated; also the second time after it had been carefully reinstated. It was discovered that, owing to static effect, the switch broke at the top of the wave at five times the normal pressure, or about 35,000 V. Experimental work was necessary to see if operation could not be ensured on the zero line. He thought that horizontal operation would prove better than vertical. It would be better to increase the number of breaks and so reduce the liberated energy at each break. One of the difficulties of the manufacturer was the chemical separation of the oil, the gas from which often got mixed with copper vapour which "shorted" all the live metal near. A switch which was designed to open at a certain loading often had to close on similar conditions. With the increasing size of generating stations, the cost and size of the oil switch would have to be increased unless some quick-operating apparatus could be evolved to reduce the generating pressure at the time of short-circuit.

MR. H. W. CLOTHIER said he received the general impression from the paper that the extent of variation of the liberated arc energy was greater than was generally realised. But the authors did not take the electrical industry into their confidence. They did not tell enough of the explanation of the variables, and he did not think that the conditions given were sufficient to account for such wide variation. What was the oil doing? It was exposed—and the atmosphere around Newcastle was often damp. The tests were made on apparatus of abnormal construction, open, and with a single break. Most commercial equipment had two breaks, and was closed in with a strong cover. Most failures were due to the bursting of tanks; but the test tank provided no equivalent. What was wanted was a knowledge of the maximum arc energies—could the authors correlate those energies with the static energies on the tank? He preferred the strong-type tanks to those that were made to yield. The easement might give out; then the weak tank would have to go. He asked if the authors could say what was the reduction in arc energy liberated where two breaks in series were employed. Were the authors justified in assuming that the variations were as large on the commercial breaker? The Association had tested commercial breakers at Carville, and the tendency was to increase the capacity of oil switches as the result of those tests. He criticised the authors' comments on the B.E.S.A. specification. The important factor of the stress on closing was not covered in the paper, but it was by the B.E.S.A. It frequently happened that research apparatus struck a zone of instability which was not met with in commercial equipment. He emphasised the need for testing plant of larger capacity in this country, where we had to submit to the humiliating position of having to take breakers abroad for testing. He suggested that a meeting of manufacturers of this country should be convened to obtain the reason why we were not equipped with testing plant equivalent to that possessed by competing nations.

MR. R. W. GREGORY did not feel sure that the inconsistency of the test results was not due to bad conditions. If the generator had been of only one-tenth the size, would the same inconsistency have obtained? He calculated that on the authors' results the chances of a switch breaking at the worst conditions in actual practice on 6,000 V would be a million to one, and on 30,000 V 2,000 to one. It was necessary to find out how much money could be expended to take care of these chances.

MR. P. R. BOULTON pointed out that the apparatus in question was not an oil switch at the actual time of break. If the oil could be made to be present at the actual time of break, the temperature could be kept down. He had arranged apparatus which broke at 10,000 ft. per second at 20 points instantaneously. The oil was not only present at the commencement of the rupture, but was under very high pressure and actually moving in the direction of flow caused by the break. The apparatus made millions of breaks on d.c. with no sign of consequent deterioration of the contacts. It did not matter what metal the contacts consisted of; steel would do as well as copper.

DR. C. C. GARRARD said that the experimental switchgear had only a remote resemblance to commercial apparatus. The variation was not a true criterion, as switch failures were due to gas explosions. The explosion energy was greater than that of the arc, and it was therefore necessary to take a more practical view of the operations. There was no difficulty in designing a switch to break 10,000 kVA. Information was wanted concerning operation at 1,000,000 kVA. He had calculated that in the largest generating station the cost of the switchgear was 1s. per kW installed.

MR. E. B. WEDMORE replied to the discussion, and said that the real research of the Association was concerned with the intensive study of the variations. Certain patents had been applied for, and the position would be explained later. Tests under heavier power and higher pressures had established the main contentions of the paper, and the same distribution had been obtained. Since the paper was written, a number of tests had been carried out at Carville which confirmed the results given in the paper. The problem was associated more with arc energy than with any other quantity.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Duty on Bakelised Paper.

On April 12th, Mr. A. ALEXANDER asked the Secretary to the Treasury whether the wrapping paper duty was being charged on bakelised paper used exclusively for electrical insulation purposes; and, if so, whether the duty was levied on the value of the body-paper or on the manufactured value.

Mr. R. MCNEILL said he understood that bakelised paper consisted of paper with a coating of varnish or other material, and that the body paper was usually of a dutiable description. In such cases, duty was chargeable on the value of the coated paper, as a whole, if within the limits of dutiable weight.

Interference with Broadcasting.

On April 12th, Mr. MONTAGUE asked the Postmaster-General whether his attention had been called to the effect of spark signals sent out constantly by the Lloyd's station at Niton, Isle of Wight, which made the wireless receiving sets for which licence fees had been paid in Sandown, Shanklin, Blackgang, and district, practically valueless; and whether he would make representations to the company concerned as to the advisability of substituting continuous-wave messages for spark signals to ships entering the Channel.

Viscount WOLMER, who replied, said that the wireless station at Niton was a Post Office station used for communication with ships and in the interests of safety of life at sea. Although some interference with the reception of the Bournemouth broadcast programmes was unavoidable in the immediate vicinity of the Niton station, there should be no serious interference at Sandown, Shanklin, and the district when reasonably selective receiving apparatus was used. The Daventry programmes could be received without difficulty even 200 yards only from the Niton aerial. An International Radiotelegraph Conference was to be held at Washington in the autumn of this year, at which the question of spark transmission from ships would be considered. In the meantime it was not practicable to take any steps to restrict the use of spark apparatus on ships.

Beam Service to Australia.

On April 12th, Viscount WOLMER informed Lieut.-Commdr. Kenworthy that the Anglo-Australian beam wireless service was opened for public traffic on April 8th. No public ceremony took place, but a Press demonstration was given on April 7th, when complimentary messages were exchanged between the Secretary of State for Dominion affairs and the High Commissioner for Australia in London and the Governor-General and the Prime Minister of the Commonwealth.

Replying to Sir H. Brittain, Viscount WOLMER said that the service was being operated successfully. It was too early at present to express an opinion upon the volume of traffic.

The Budget.

During the Budget discussions certain members took strong exception to the Government's proposal to abolish the Ministry of Transport.

Mr. TOWNEND, a Labour member, said that the Ministry of Transport was empowered to give effect to the Electricity Acts of 1919 and 1926. The latter Act involved an expenditure of £33,500,000 of public money. By 1940, in the opinion of certain authorities, the Ministry of Transport would have had control over the expenditure of no less than £200,000,000 of the taxpayers' money. And yet without a word of explanation they were told that that Ministry was once again to be divided into more than one department, and huge combinations and groups would find that questions would be dealt with in different ways. It was important that all these matters should be under one head.

Mr. J. HUDSON, another Labour member, pointed out that although the country had entered on an enormous electricity scheme, to be supervised by a special department, the Government had decided to scrap that particular department.

Housing Enterprise.

In a recent *Evening News* advertisement a housing estate company announced a number of attractive features which distinguished its houses, stating that "among the standard fittings are electric radiators, cooker, and a 2-valve wireless set with a loud speaker."

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Machine Tools in the Power Plant.

The problem of equipment for the workshop connected with the power plant is one of long standing. Some folk seem to muddle along without tools of any sort; when anything goes wrong, rush tactics predominate, accompanied by rush prices, and much unnecessary loss is incurred.

The power plant of any size can never be an ideal one without machine tools at hand for emergencies; the real live engineer realises that the extra cost of all repairs would in itself soon pay the cost of tools, and uses every effort to get them installed. One of the best equipments of this sort known to the writer was obtained by the engineer-in-charge in an interesting manner, which he usually describes as "free of charge," and is well worth the attention of others. On his taking charge of this plant, his only equipment consisted of an old lathe and an older drilling machine; pointing out their uselessness to the powers-that-be, he suggested that he should be allowed the disposal of all scrap machinery and metal about the place, and that the money so received be put aside as a tool and equipment fund.

To this proposal the firm agreed, and he very soon got busy; within two years he not only purchased his machine tools, consisting of lathe, shaper, two drilling machines, large and small, and a small planing machine, but many other appliances, some of them for testing purposes. Everything he wants is on hand, and all was obtained in this way.

The firm being an old one, a good deal of old machinery, far more than anyone but the engineer realised, was lying about. This was all dismantled and most of it was broken up; the various metals were sorted, brass, bronze, copper, tin, lead, and white metal, were all carefully graded, and soon mounted up to a considerable weight. Tenders were then invited from those having a market for metals, and no machinery or junk of any sort was sold in bulk, but as metal of various kinds, all of which commanded market prices; this entailed very little cost, the necessary sorting being mostly a spare-time occupation, but it increased the returns considerably. With this equipment the engineer is saved a good deal of worry and is to a large extent independent of others. All running repairs and renewals can be put in hand in good time and in the easiest manner, and many little things are got ready in advance for the next overhaul. It is also a wonderful help when getting in estimates for various alterations and the like; the fact that he has plant of his own has without doubt brought about much keener prices all round. It is also possible to carry out many experiments of various kinds that would be unthought of if every little stud or pin had to be purchased outside.

This engineer also puts discarded plant, not completely worn out, in a more saleable condition when it is thought that better prices will result, thus making his own pathway to better plant easier. In every plant there is some use for machine tools, and once they are installed more and more jobs are found for them; everything is kept in a better state of efficiency throughout the plant. Many slight leaks can be stopped that without tools are apt to be neglected, and it is soon apparent that it pays, and often handsomely, to have them as part of the engineer's outfit.

W. S.

Belfast, *April 13th*, 1927.

Legal.

"Electric Hare" Dispute.

In the Chancery Division on April 12th, Mr. Justice Tomlin had before him two motions by the Liverpool Greyhound Club, Ltd., and the Leeds Greyhound Association, Ltd., asking for injunctions against the Greyhound Racing Association, Ltd., restraining the latter from claiming that it was the sole licensee for Great Britain in respect of a patent for electrically-operated "hares." For the first plaintiff it was stated that, with the apparatus in question, the "hare" could be made to travel at 60 miles per hour. Counsel for the defendant company offered to give an undertaking in the terms of the notice of motion, without making any admission as to any question at the trial. That undertaking being accepted by the plaintiffs, Mr. Justice Tomlin said that he would make no order except that the costs of the motion would be costs in the action.

Fraudulent Conversion Charge.

The Times reports that on April 12th, before Alderman Sir Harold Moore, at the Guildhall, Elie Stacey Charlier, a company promoter, was charged with the fraudulent conversion of money entrusted to him by various persons for the preliminary expenses of forming an electric railway company in Canada. The prosecution stated that the accused was an American citizen who was adjudged bankrupt in July last. The main allegation against him was that he only remitted to Canada small portions of the sums entrusted to him and appropriated the remainder for his own use. Mention was made of three sums amounting to £5,450 which had been handed to the accused. The case was adjourned.

La Radiotechnique v. Norton Wireless Co., Ltd.

Mr. Justice Romer, in the Chancery Division on April 12th, heard a motion by La Radiotechnique, a French company, for an injunction restraining the Norton Wireless Co., Ltd., of 17, Norton Folgate, E.C., from passing off radio valves not of the plaintiff company's manufacture as and for their goods, and in particular from selling or offering for sale valves marked with the words "Radio Micro" and "Radio Micro Special" in cartons similar in appearance to those of the plaintiff company.

Mr. Courtney Terrell, for the plaintiffs, said that his clients' goods were well known in the trade, and it was obvious that the defendant company's cartons were a copy of theirs.

His Lordship granted the plaintiffs an injunction *ex parte* over the first Friday next sittings.

Reviews.

Heat-Power Engineering. Part I, Thermodynamics and Prime Movers. By William N. Barnard, Frank O. Ellenwood, and Clarence F. Hirshfeld. New York: John Wiley & Sons, Inc. London: Chapman & Hall, Ltd. Pp. xii+493; 251 diagrams and numerous charts. Price 22s. 6d. net.

To those of our readers who may be familiar with "Hirshfeld and Barnard's Elements of Heat-Power Engineering" it may be mentioned that the volume under review constitutes the third edition of that well-known American textbook. Owing, however, to the new ideas which have been developed during recent years in connection with the conversion of heat into mechanical work and the improvement in the methods of treating the theories underlying this conversion, it has been found necessary to rewrite many of the chapters in their entirety, while in the others an attempt has been made to bring them up to date. The result is a book which may be regarded as covering the whole field of the various theories underlying what in this country is known as modern heat engine practice.

For the benefit of those who are not acquainted with this work it may be mentioned that it covers what the authors call the full year's course in heat-power engineering of the American technical colleges and universities, and since a knowledge of mathematics up to and including the differential and integral calculus is assumed, as well as a knowledge of mechanics and physics, it might be suggested that it would prove suitable for a second or even a third year's course in our own engineering colleges. At the same time it is not to the student alone that this book should make an appeal. To the power-station engineer and the engineer who is in any way connected with the design and manufacture of modern power-station equipment a knowledge of fundamental principles underlying the working of such equipment is absolutely essential, particularly if he is to appreciate the value of the various developments which are being continually brought to his notice. Thus, much is being said at the present time about the advantage of using high-pressure steam superheated to a high temperature. The question at once arises as to the extent to which either or both of these can be employed to increase the thermal efficiency of the steam plant. Again, the question of re-heating the steam between the various expansion stages in the turbine and the bleeding of steam at various pressures for regenerative feed-water heating, is one which is becoming of increasing importance as the capacity of our turbo-alternator units is increased. Similarly, the theory underlying the various problems in internal combustion engine practice are also fully investigated. Other questions which are less prominent at the present time, but which, nevertheless, may assume great importance in the near future, are also discussed in their theoretical aspects, such as, for example, the binary cycle engine, and the engineer who has a knowledge of the fundamental principles underlying these questions is well equipped to understand the full value of such developments as he may read of from time to time in the proceedings of our technical institutions and in the engineering Press.

With regard to the general scope of the book, it will be sufficient to mention that it proceeds along more or less accepted lines, the alternation of theory and practice being skilfully maintained to retain the interest of the student throughout, but we feel that as regards the references to

actual engines and plant the value of the book might have been enhanced—particularly from the point of view of the technical college student—by the inclusion of the reproduction of a few well-chosen photographs. Here, also, we cannot fail to notice the fact that the volume before us is the third edition of an earlier work. This is particularly noticeable in the chapter on steam turbines, which, in view of their supreme importance in the development of power from heat, are very inadequately dealt with, only 11 pages being given to the description of the various types of turbine and their method of operation as compared with 50 pages devoted to the description of reciprocating engine types. At the end of the book there is a very useful collection of problems classified according to the chapters, the answers being appended to enable the student to check the accuracy of his work. Various steam tables and charts are also appended, and in this connection it is noteworthy that the properties of steam for pressures up to 1,200 lb. per sq. in. and superheat temperatures 400 deg. F. above saturation temperature are given, together with complete data for very high vacua. We cordially recommend this book to all engineers who are anxious to study the theories underlying the conversion of heat into power.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1925.

10,717. "Manufacture of electroionic discharge tubes." Edison Swan Electric Co., Ltd. (Radio-Rohren Laboratorium Dr. G. Nickel Ges.). December 29th, 1925. (Convention date not granted.) (239,959.)

27,407. "Radio-frequency amplifier." S. Cohen. October 31st, 1925. (267,993.)

31,371. "Wireless and like signalling installations." M. J. Goldberg and Sohne Ges. December 11th, 1924. (244,486.)

31,892. "Inductance coils." M. E. Elliott. December 17th, 1925 (268,007.)

31,894. "Electric circuit breakers, relays, and the like." A. Reyrolle and Co., Ltd., and N. Cooke. December 17th, 1925. (268,008.)

32,096. "X-ray apparatus." W. Moppett. December 18th, 1925. (268,012.)

32,220. "Filter diaphragms for electrolytic purposes." Dr. J. Billiter and Siemens & Halske Akt.-Ges. December 23rd, 1924. (245,127.)

32,316. "Terminals or connectors for electrical apparatus or appliances." J. J. Rowe. December 22nd, 1925. (268,025.)

32,480. "Electrically-driven timepieces." M. A. Juillerat. March 16th, 1925. (249,078.)

32,481. "Vacuum-tube generators for high-frequency alternating currents." W. J. Brown and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (268,028.)

32,482. "High-frequency electrical apparatus of the type employing thermionic valves." W. J. Brown, C. R. Burch, E. Y. Robinson, and Metropolitan-Vickers Electrical Co., Ltd. December 23rd, 1925. (268,029.)

32,495. "Telegraph receivers." Mockrum-Kleinschmidt Corporation. December 28th, 1924. (245,149.)

32,497. "Electrical wave filters." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 23rd, 1925. (268,030.)

32,505. "Signalling devices for use in connection with telephone or like systems." Automatic Telephone Manufacturing Co., Ltd., and C. R. Woodland. December 23rd, 1925. (Addition to 164,313.) (268,031.)

32,622. "Electrical inductances." B. Hesketh. December 24th, 1925. (268,038.)

32,629. "Electric transformers regulatable by varying the active number of coils." E. Hering. December 24th, 1925 (268,039.)

32,636. "Variable inductances and the like." W. S. Smith, H. C. Channon, and E. W. Smith. December 24th, 1925. (268,040.)

32,642. "Submarine sound signalling." W. Gardner. December 24th, 1925. (268,042.)

32,690. "Fog penetrating lamps or lights for illuminating or signalling purposes." E. V. Hayes-Gratze. December 28th, 1925. (268,046.)

32,718. "Galvanic batteries." Count De Mieres. December 28th, 1925. (268,047.)

32,732. "Space discharge tube systems for electric wave signalling." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). December 28th, 1925. (268,048.)

32,806. "Electric water heater of the storage type." A. E. Lewis. January 14th, 1925. (246,120.)

32,831. "Carrier-wave signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). December 29th, 1925. (268,054.)

32,837. "Secret signalling." M. Trouton. December 29th, 1925. (268,055.)

32,842. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Ostline. December 29th, 1925. (268,058.)

32,951. "Electrical fuses." Midland Electric Manufacturing Co., Ltd., and W. L. Barber. December 31st, 1925. (268,060.)

1926.

315. "Charging of electric accumulators." R. J. Middleton. January 4th, 1926. (268,063.)

357. "Apparatus for automatically charging electric storage batteries." L. A. Wilde. January 6th, 1926. (268,064.)

618. "Cases for portable secondary batteries." A. E. Frost and A. E. Flowers. January 11th, 1926. (268,066.)

829. "Multi-layer inductance coil for use on wireless receiving apparatus." W. A. Tester. January 12th, 1926. (268,067.)

845. "Miners' safety and like lamps." E. A. Hailwood. January 12th, 1926. (268,068.)

869. "Electric lamp holders." Sun Electrical Co., Ltd., and W. Curtis. January 12th, 1926. (268,069.)

2,373. "Electric heating elements." C. H. Roddis. January 27th, 1926. (268,079.)

2,500. "Terminals for wireless apparatus and like purposes." W. Okines. January 28th, 1926. (268,081.)

2,977. "Variable electric condensers." P. Blok. February 2nd, 1926. (268,086.)

5,273. "Switchboards for controlling electric circuits." British Lighting and Ignition Co., Ltd., and J. C. Hutton. February 24th, 1926. (268,106.)

6,557. "Holders for thermionic valves and the like." India Rubber, Gutta Percha & Telegraph Works Co., Ltd., and J. Haseltine. March 9th, 1926. (268,116.)

6,612. "Thermionic valve holders." C. J. Payne. March 9th, 1926. (268,118).

6,806. "Rectifying devices." British Thomson-Houston Co., Ltd. March 11th, 1925. (249,135.)

7,817. "Electrical terminals or connections." J. H. Tucker & Co., Ltd., and T. R. Martin. March 22nd, 1926. (268,128.)

7,904. "Electric heaters." British Thomson-Houston Co., Ltd. March 21st, 1925. (249,562.)

8,286. "Alternating-current measuring instruments." B. Dunglinson (Republic Flow Meters Co.). March 26th, 1926. (268,130.)

8,309. "Apparatus for carrying or holding together a number of galvanic batteries." Oldham & Son, Ltd., and M. Smith. March 26th, 1926. (268,131.)

8,374. "Dry batteries." Lissen, Ltd., and R. P. Richardson. March 27th, 1926. (268,132.)

8,861. "Directional wireless signalling." Marconi's Wireless Telegraph Co., Ltd. April 2nd, 1925. (250,256.)

8,880. "Adjustable short-circuit device for electrical measuring instruments of the induction type." Landis & Gyr Soc. Anon. August 3rd, 1925. (256,180.)

9,371. "Electric lighting devices." R. J. Heaton. April 9th, 1926. (268,140).

9,609. "Means for protecting electric transmission lines." J. P. Gil. April 12th, 1926. (268,143.)

9,766. "Electric percolators." Metropolitan-Vickers Electrical Co., Ltd. April 24th, 1925. (251,262.)

10,384. "Electric condensers." International General Electric Co., Inc. April 22nd, 1925. (251,274.)

10,389. "Private automatic branch telephone exchanges." Relay Automatic Telephone Co., Ltd., and B. B. Johnson. April 20th, 1926. (268,150.)

11,346. "Sound-reproducing diaphragms." R. Custerson. April 29th, 1926. (268,160.)

12,094. "Devices for the insertion of the electrolyte and for the evacuation of gases in electric accumulators." Accumulateurs Tudor Soc. Anon. May 8th, 1925. (252,024.)

12,728. "Automatic telephone systems." Deutsche Telephonwerke und Kabelindustrie Akt.-Ges. September 17th, 1925. (258,547.)

13,522. "Manufacture of accumulators or electrical storage batteries." S. J. Williams. May 28th, 1926. (268,179.)

14,277. "Loud speakers." American Bosch Magneto Corporation. February 5th, 1926. (265,538.)

16,204. "Electric cables." Macintosh Cable Co., Ltd., and A. W. Williams. December 23rd, 1925. (Divided application on 32,414/25.) (268,194.)

16,221. "Fault-indicating devices for transformers." Allmanna Svenska Elektriska Aktiebolaget. November 9th, 1925. (Addition to 255,836.) (260,944.)

16,736. "Television systems." Westinghouse Electric & Manufacturing Co. July 13th, 1925. (255,057.)

16,843. "Electrical plug boxes." E. Maté. July 4th, 1925. (254,754.)

18,545. "Contact device for electrical switchgear." Maschinenfabrik Oerlikon. September 16th, 1925. (258,557.)

18,598. "Time-lag electro-responsive devices." British Thomson-Houston Co., Ltd. August 5th, 1925. (256,603.)

18,864. "Electric welding machines." J. F. Lawson. August 27th, 1925. (257,581.)

20,091. "Variable electric condensers." C. Zwicker. June 28th, 1926. (268,211.)

20,087. "Dry cells and method of making same." General Dry Batteries, Inc. August 24th, 1925. (Addition to 244,494.) (257,288.)

22,942. "Electrically-heated sterilisers, egg-cookers, and the like." E. Shrubsole. September 17th, 1926. (268,222.)

23,310. "Coupling units for use in wireless circuits." A. E. Watkins. December 21st, 1925. (Divided application on 267,619.) (268,224.)

24,215. "Apparatus for producing high-frequency oscillations for medical purposes." Reiniger, Gebbert & Schall Akt. Ges. December 16th, 1925. (263,093.)

25,052. "Means for selectively cutting out a rectifier on a back-ignition taking place in the same." Akt.-Ges. Brown, Boveri et Cie. November 27th, 1925. (Addition to 251,539.) (262,062.)

26,366. "Calculator for readily determining the relationship between wavelength, inductance, and capacity in electrical circuits." F. H. Haynes. October 22nd, 1926. (268,243.)

29,734. "Means for registering faults of insulation in insulated electric conductors." Allgemeine Elektricitats-Ges. November 24th, 1925. (262,113.)

30,635. "Electric arc welding or coating with material." International General Electric Co., Inc. December 3rd, 1925. (262,453.)

30,795. "Filter diaphragms for electrolytic purposes." Dr. J. Billiter and Siemens and Halske Akt.-Ges. December 23rd, 1924. (Divided application on 245,127.) (262,470.)

31,324. "Amplifying valves for wireless telephony." Schweiz Gluhlampenfabriken Akt.-Ges. and K. Burk. December 11th, 1925. (262,806.)

1927.

2,871. "Joints for high tension electric cables." Pirelli & Co. June 12th, 1926. (Divided application on 255,033.) (Addition to 255,033.) (268,271.)

3,238 "Electric oscillation generators." British Thomson-Houston Co., Ltd. February 26th, 1926. (266,690.)

6,117. "Thermionic electrodes." British Thomson-Houston Co., Ltd. March 6th, 1926. (267,142.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 13th :—

Wizard. No. 478,601. Class 6. Domestic clothes washing machines.—General Electric Co., Ltd.

Unitone (lettering and design). No. 472,329. Class 8. Electrical inductances.—Igranic Electric Co., Ltd.

Ace. No. 477,001. Class 8. Dry batteries (electrical) not for medical purposes.—E. Kohn, 115, Dulwich Road, S.E.24.

Van Raden. No. 477,248. Class 8. Electrical storage batteries.—Van Raden & Co., Ltd., 567, Foleshill Road, Coventry.

Bluebell (design only). No. 478,001. Class 8. Radio-telephonic and telegraphic apparatus and parts thereof.—Lissen, Ltd.

Varsola (lettering and design). No. 478,407. Class 8. Radio-telephonic and telegraphic apparatus and parts.—R. R. Thompson, Ltd., 38-42, Chestnut Grove, New Malden.

Jonphilite. No. 478,410. Class 8. Electric cables.—Johnson & Phillips, Ltd.

Splendor (lettering and design). No. 476,164. Class 13. Electric incandescent lamps.—M.S.L., Ltd., 50, Holborn Viaduct, E.C.1.

Zelco. No. 477,350. Class 13. Electric lamps (ordinary).—I. Weiner, trading as the Zenith Lamp Co., 5, Dyers' Buildings, Holborn, E.C.1.

Tenax No. 478,434. Class 13. Wall plugs or sockets.—Hommade, Ltd., 150, Great Titchfield Street, W.1.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AINSDALE (SOUTHPORT).—Cinema; Messrs. Sutton, builders.

BARNSLEY.—Artificial light installation, Market Street centre; medical officer of health.

BEIGHTON.—School (300 places), for Derbyshire E.C.; H. W. Skinner, clerk, County Offices, Derby.

BLACKBURN.—Improvements to Emmanuel School (£2,000); Rev. J. E. Samuel, vicar.

BLACKPOOL.—Additional housing scheme (78), Bispham, for the T.C.; borough surveyor.

BRADFORD.—Reinstatement, after fire (£100,000 damage), wool warehouses and offices, Manor Row; J. Riddiough and Co. Garages for motors and railless-cars, Thornton Road; city architect.

BREDBURY AND ROMILEY (CHESHIRE).—Additional 50 houses, for the U.D.C.; surveyor.

BRIERLEY HILL.—Additional housing scheme (68), for the U.D.C.; surveyor.

BROMLEY (KENT).—Premises for mental defectives (£16,000), for the B.G.; Burnand, Pickett, Ltd., builders, Wallington, Surrey. Additional 40 houses, for the T.C.; Percy A. Coad, architect, 90, Nightingale Road.

BROMSGROVE.—Additional 56 houses, Rubery, for the R.D.C.; surveyor.

BURPHAM (NEAR GUILDFORD).—50 houses, Paddocks estate; Hodgson, Lunn & Co.

COCKERMOUTH (CUMBERLAND).—Bank, Main Street, for the National Provincial Bank, Ltd.

CROYDON.—Arcade additions, North End; S. Burmseter. Additions, The Picture House, North End; Clayton and Black, Prince Albert Street, Brighton. Housing scheme (336), Mitcham Road, for borough engineer.

(ADDISCOMBE).—Cinema, Lower Addiscombe Road; Addiscombe Cinema Co., Ltd., 46, High Street.

DUDLEY.—Rehousing scheme (180 houses to be replaced), for the T.C.; borough engineer.

DUNDEE.—Linoleum factory; Gray, Robertson & Co., solicitors. Shopping centre at Craigiebank housing scheme; city architect.

ECCLES (LANCS.).—Post office and telephone exchange, for H.M. Office of Works, King Charles Street, London, S.W. Development of estate (70 houses), Bridgewater Estates, Ltd.

EXETER.—Three blocks of almshouses, for the Municipal General Charities; Wright & Jerman, 21, Cathedral Yard, architects.

FAREHAM.—96 houses, for the U.D.C.; district surveyor.

GILLINGHAM (KENT).—Boot repairing factory, Canterbury Street, for the Co-operative Society; L. G. Ekins, architect.

GODALMING.—Engine and generator houses, workshop, &c., Borough Road pumping station, for the T.C.; H. C. Head, consulting engineer, 90, High Street, Winchester.

GOLDTHORPE.—Office and stores at sub-station for Dearne District Electricity Board.

HASTINGS.—Alterations, Palace Hotel, White Rock; H. Ward & Son, architects.

HOYLAKE.—Extensions to children's home, for Wirral B.G.; Finchett, Lancaster & Archer, architects, 13, Hoghton Street, Southport.

IRISH FREE STATE (DUBLIN).—Jam factory, Poplar Row and Annesley Place, for R. & W. Scott.

KIDDERMINSTER.—Extensions to sugar beet factory (£90,000). Foley Park, for the West Midlands Sugar Beet Co.

LANARKSHIRE.—Infant department at Bishopbriggs School (£7,000); clerk, County Education Authority, Hamilton.

LANCASTER.—Extension of the Royal Grammar School; S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

LEEDS.—Housing scheme (118), Meanwood and York and Selby Road estates. Pavilions and conveniences and rebuilding of garages, &c.; W. T. Lancashire, city engineer, Municipal Buildings.

LEICESTER.—1,200 houses, Braunstone estate; Lanchester, Lucas & Lodge, for Corporation.

LEITH.—Shed at Harbour (£16,400); harbour engineer.

LIMEHURST.—Rating offices, with electric lighting and heating, Waterloo, for the R.D.C.; J. W. Carey Titterington, clerk, 113, Old Street, Ashton-under-Lyne.

LINCOLN.—Showrooms and offices (£10,000), Silver Street, for the T.C.; city surveyor.

LONDON (BARKING, E.).—Headquarters, for the Essex Territorial Army Association; secretary, Market Road, Chelmsford.

(CAMDEN TOWN, N.).—Alterations, fire station, for L.C.C.; J. & C. Bowyer, Ltd., Norwood.

(CATFORD, S.E.).—Bazaar premises, 130, Rushey Green, for F. W. Woolworth & Co., Ltd., Kingsway, W.C.

(FULHAM, S.W.).—Buildings, Fulham Palace Road, Silverton Road, and Crabtree Lane; Wallis, Gilbert & Partners, 29, Roland Gardens, S.W.

(ILFORD, E.).—Garage, showrooms, shops, &c., Eastern Avenue (£45,000); Super Mobile, Ltd.

(KENSINGTON, S.W.).—Alterations, Sussex Place and Onslow Gardens; Westminster Bank, Ltd. Extensions, Town Hall and central library; borough engineer. Rebuilding Kensington, Fulham and Chelsea Hospital, Finborough Road; Sir Aston Webb & Son.

(KENTISH TOWN, N.W.).—Polytechnic buildings, Kentish Town Road; L.C.C. Education Committee.

(ST. PANCRAS, N.W.).—Workshops, 12-20, Fitzroy Place; Association for Promoting the Welfare of the Blind. Extensions, Grafton Street; Maple & Co., Ltd.

(STREATHAM, S.W.).—32 houses, Sherwood Park Road; Wates, Ltd. 30 houses, Pendennis Road; Chapple and Utting. 37 houses, Southcroft Road; Thomas and Westcott. 80 houses, Southcroft and other roads; E. Clarke & Sons.

(TOOTING, S.W.).—Kitchen reorganisation, South Western Hospital; Metropolitan Asylums Board.

MACCLESFIELD.—Pooster station, waterworks, for the T.C.; borough engineer. Additional 103 houses, for the T.C.; borough surveyor.

MILNGAVIE.—Cinema, Mrs. Patrick Breckenridge, Milngavie.

MITCHAM.—Extensions to maternity home, Devonshire Road, for the U.D.C.; Chart, Son & Reading, architects, Union Bank Chambers, Croydon.

NELSON (LANCS.).—Cabinet works, Scotland Road, for W. Blades (£8,000).

NEWPORT (I. OF W.).—Joinery works, Leverton Row; H. W. Morey & Sons, Ltd. Municipal offices, Town Lane; borough engineer.

NEWTON ABBOT.—Electricity supply, new factory, Kingsteignton Road; Webmetals, Ltd.

ORMSKIRK.—Housing scheme (50), for the West Lancashire R.D.C.; A. Dickenson, surveyor, Derby Street, Southport.

PAISLEY.—Wing at Museum; the curator.

POOLE.—Bathing pavilion (£10,000), for the T.C.; borough surveyor.

SALISBURY.—Bazaar premises, Silver Street, for F. W. Woolworth & Co., Ltd., Kingsway, London.

SHEFFIELD.—South-Western District Sorting Office for H.M.O.W.; Contracts Branch, King Charles Street, London, S.W.1.

SOUTH SHIELDS.—School of art; Education Committee. Amusement and dancing pavilions, South Foreshore; H. Hill, architect for Mr. C. J. Daniels.

STAMFORD (LINCS.).—Re-erection of Palace Theatre, Blackfriars Street, for R. R. & E. D. Edinborough (£6,000).

STOCKPORT.—Additional 100 houses, for the T.C.; borough surveyor.

STRETFORD.—Elementary school, King's Road, for Education Committee; P. Hodgkinson.

TORQUAY.—Additions, Natural History Museum, Babbacombe Road; trustees. 128 houses, Westhill estate, for Corporation; Universal Housing Co., Ltd.

WADDON.—23 houses and 24 flats, Stafford Road; Southern Foundries, Ltd.

WINCHESTER.—Out-patients' department (£12,000), Royal Hampshire County Hospital; secretary.

WORCESTER.—Nurses' home (£12,000), for the B.G.; the clerk.